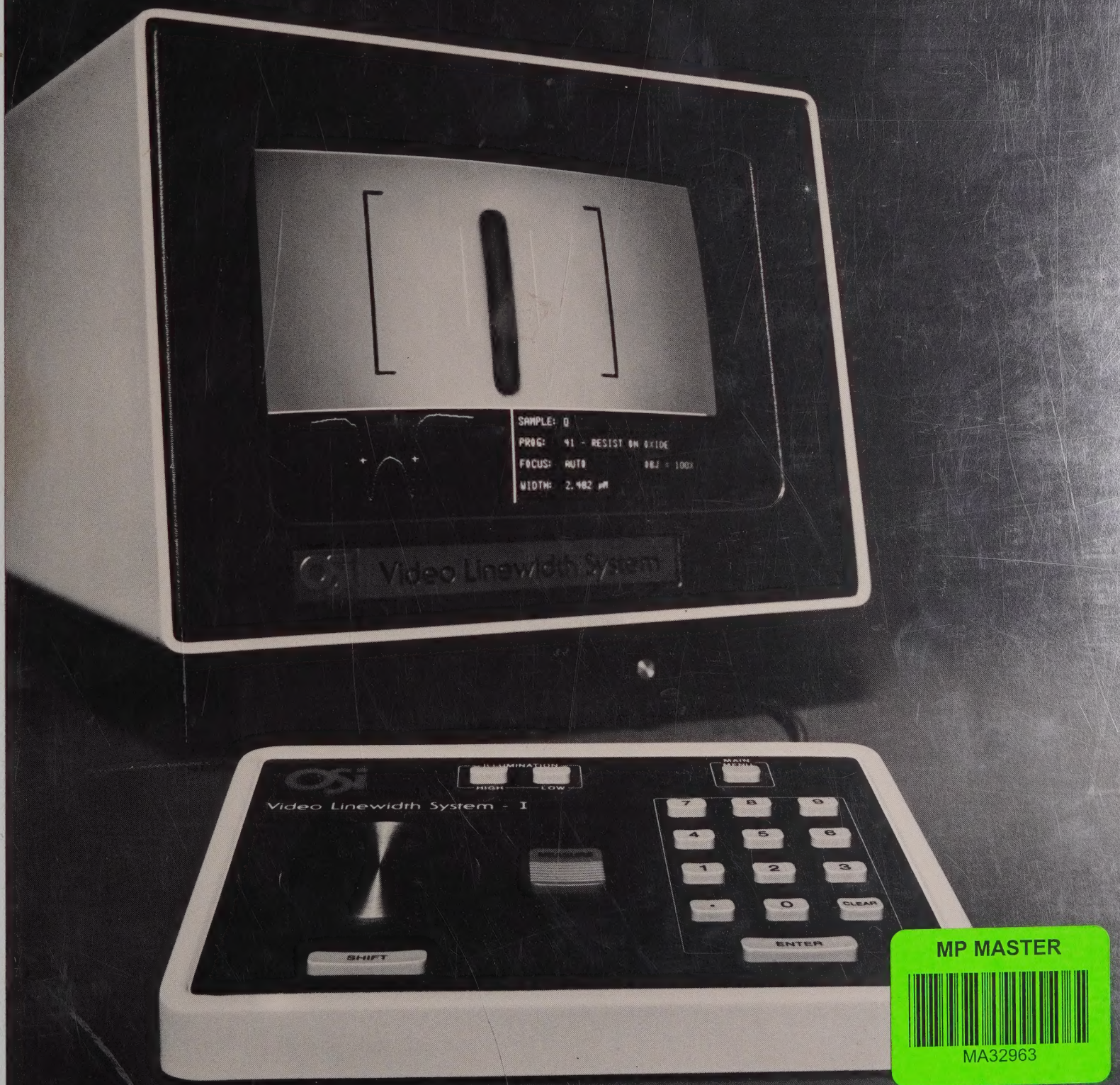
VLS-I
Video Linewidth System
Maintenance Manual



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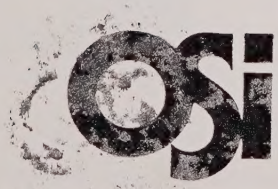

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MARCH 1986

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Please call us at the above number to report reliability problems that have not been resolved by normal maintenance.

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EQUIPMENT WARRANTY

OSI warrants that the products delivered under this order will be free from defects in material and workmanship under normal use and service. OSI's obligations under this warranty are limited to replacing, repairing, or giving credit for, at its option, any of said products, if within six (6) months after shipment, they are disclosed to OSI's satisfaction to be thus defective.

This warranty is stated in lieu of all other warranties of merchantability and fitness for a particular purpose, and of all other obligations or liabilities on OSI's part, and it neither assumes, nor authorizes any other person to assume, for OSI, any other liabilities in connection with the sale of the said articles. This warranty shall not apply to any product which shall: have been repaired or altered, except by OSI, or in accordance with any handling or operating instructions supplied by OSI; or which shall have been subjected to unusual physical or electrical stress, misuse, abuse, negligence or accidents. The aforementioned provisions do not extend the original warranty period of any product which has been either repaired or replaced by OSI.

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Note: Effective with shipments made on or after March 1, 1986, the warranty is one (1) year from date of shipment.

Video Linewidth System
Nikon

INTRODUCTION

The VLS-I Video Linewidth System provides fast, repeatable measurements on wafers, photomasks, magnetic heads, and other small geometries. It includes a camera detector and image rotation system, microscope with a piezo-driven autofocus system, a keyboard, a CRT monitor, and an 8086-based electronics controller. The system mounts on the trinocular port of a stand-alone microscope or on OSI's line of Microvision 7, and Microvision 15 Automatic Wafer Inspection Stations to incorporate their wafer handling capabilities.

The system is self-calibrating, menu-driven, and user programmable. Measurements are stored in a statistical data base.

The VLS-I is designed to measure features located between measurement gates on a CRT video display. The height and positioning of these gates, as well as the distance between the gates, is keyboard controlled. Automatic microscope illumination adjustment ensures an optimal, machine-repeatable profile of the area between the measuring gates. A real-time digitized profile of the measured feature is displayed in the lower left corner of the CRT monitor. Microfocus automatic focusing, followed by thorough feature scanning, yield the linewidth measurements (in micrometers or microinches) which are displayed in the data section (lower right corner) of the CRT.

The VLS-I is designed and manufactured for trouble-free operation. To assure this, it is recommended that the operators and technicians become thoroughly acquainted with the system and its operation. Untrained maintenance personnel should not work on this system. Training from OSI is available at no charge during the warranty period. If there are any questions concerning the performance of the VLS-I, or if training has not yet been provided, please call OSI Field Service at (415) 490-6400, or contact the local sales office.

SYSTEM DESCRIPTION

Specifications

- Self-calibrating, Autoilluminating, and Autofocusing
- Measurement Range: 0.5–200um on wafers and photomasks
- Precision: Wafers sigma value = 0.010um
  Photomasks sigma value = 0.005um
- Accuracy: Measured on an NBS or NBS traceable AR chrome mask, using PROGRAM-0 with threshold settings the same as used for system calibration. The average of ten measurements shall have the following maximum errors:
  100X = 0.02 microns
  60X = 0.03 microns
  40X = 0.05 microns
  20X = 0.10 microns
  10X = 0.20 microns
  5X = 0.40 microns
- Measurement Time: 4 seconds for 3um line, including autoillumination and autofocusing
- Output: RS232C serial interface

Standard Equipment

- Video Detection and Rotation System
- "Microfocus" Autofocusing System
- Control Keyboard
- 12" CRT Monitor
- Electronics Controller and Cabling
- Calibration Mask Traceable to NBS
- Wafer Holder(s) and/or Mask Holder
- Operator and Maintenance Manuals

SYSTEM DESCRIPTION

Specifications

Options

- Thermal Printer and 10 Rolls Tape
- Multi-voltage Isolation Transformer (100, 200, 210, 220, 240 VAC 50/60 HZ)
- Autovideo Reference
- Alphanumeric Keyboard
- Clean Room Operator and Maintenance Manuals

Special Applications Software

- SECS II Interface Software
- Cosine Correction Software
- Registration Software
- Min/Max Software

Dimensions

• Electronics Control Module:	6.5" x 16" x 28" (H x W x D)
• CRT Monitor:	12" x 13.5" x 12" (H x W x D)
• System Height (with microscope):	34"
• System Shipping Weight:	150 lbs.
• System Shipping Volume:	13.5 cubic ft.

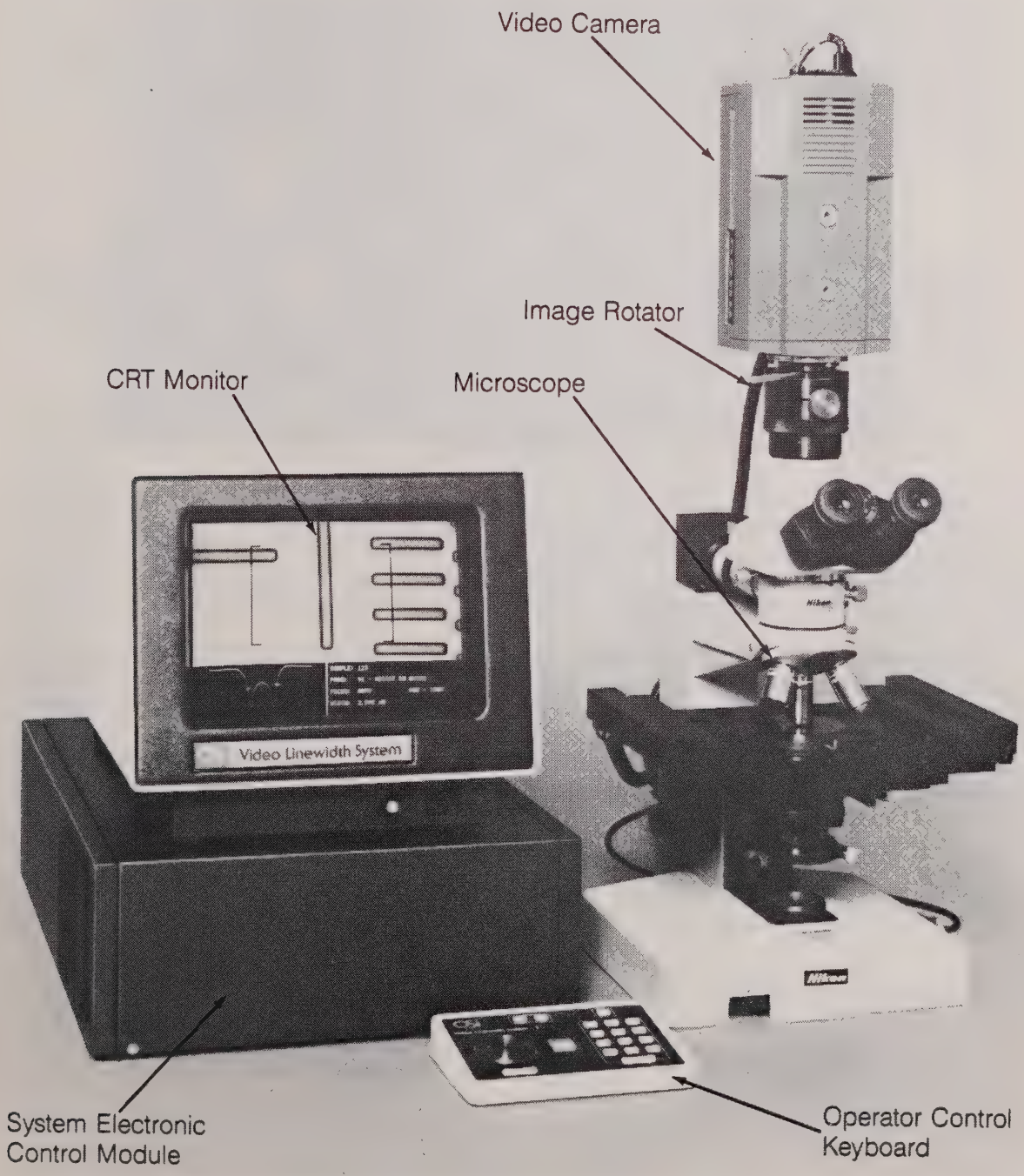
Power Requirements

- 115 volts @ 5 amps AC single-phase 50/60Hz
- 100, 200, 210, 220, 240 VAC, 50/60 Hz

Note:
OSI RESERVES THE RIGHT TO MAKE CHANGES IN MATERIALS OR DESIGN WITHOUT OBLIGATION TO INCORPORATE SAME INTO EQUIPMENT OF PRIOR MANUFACTURE. SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

SYSTEM DESCRIPTION

The VLS-I consists of several major structures: video camera, image rotator, microscope, CRT monitor, operator control keyboard, and system electronic control module. These structures will all be described in this manual.



SYSTEM DESCRIPTION

Video Camera

The camera produces a real-time digital profile of the feature being measured. The digitized image data is stored in the memory. A composite of the stored data is displayed on the CRT monitor as a profile of the digitized image. Periodically, the system checks a reticle in the system's optical path and self-calibrates. Using this method, the system ensures uniform performance and long-term stability under fluctuating temperature and environmental conditions.

Image Rotator

The image rotator interfaces the microscope to the video camera, and permits rotation of the camera with respect to the microscope so that lines at various angles can be measured vertically. Precise 90-degree rotation permits rapid switching from horizontal to vertical lines. Measurements in the Y-direction are obtained by rotating the video detection assembly.

Microscope

As stated in the Introduction, the VLS-I may be mounted on an OSI Microvision Wafer Inspection Station to incorporate wafer handling capabilities. It may also be microscope-mounted for conventional wafer/photomask measurements. In the latter case, trinocular metallurgical microscopes with incident and transmitted light can be used.

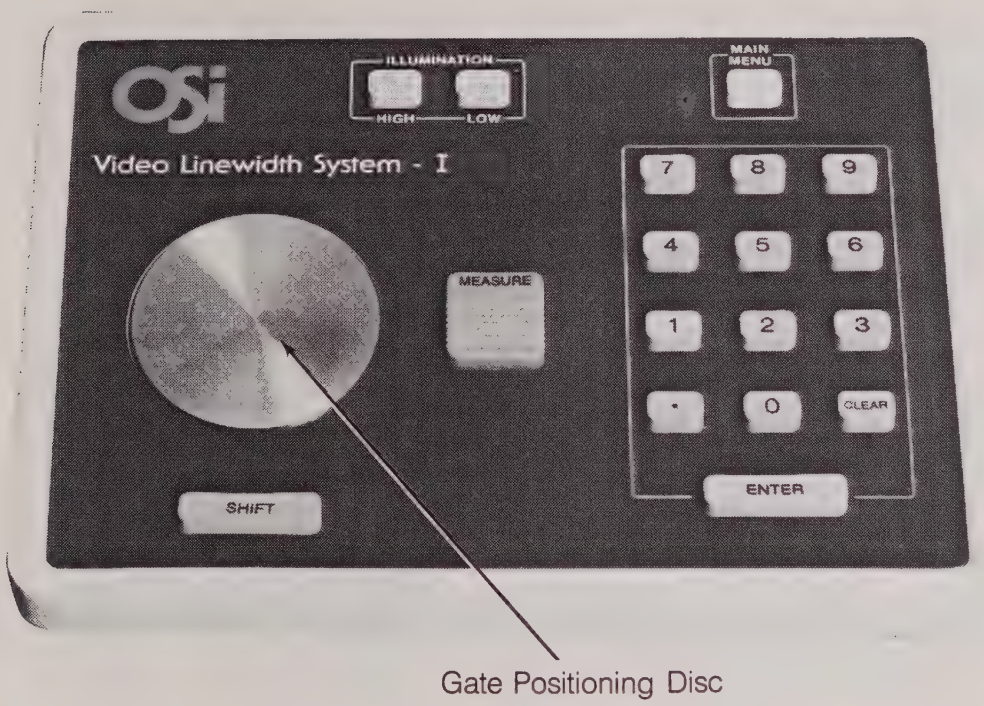
Measurements are made with factory-calibrated objectives. Microscope illumination is automatically adjusted to obtain an optimal, machine-repeatable profile. On the microscope the stage's piezo-driven autofocusing (microfocus) mechanism obtains best focus by maximizing the slope of the digitized profile at the threshold of interest. Microfocus continues to compare slopes as the piezo-driven stage moves through its focus range until optimal focus is achieved. On an Inspection Station the laser based automatic focusing system moves the wafer loaded chuck to achieve optimal focus.

CRT Monitor

The CRT monitor displays a live image and digitized profile from the camera.

SYSTEM DESCRIPTION

Operator Control Keyboard



Measurement Gate Positioning Disc

Press the positioning disc to move the gates as a pair--right, left, up, or down. The gates move only within the measuring area and a warning beep will sound when one of the gates reaches its boundary.

Press the SHIFT key on the keyboard and the disc simultaneously to make the gates shorter or taller. Press the bottom of the disc and the gates grow downward; press the top and they shorten upward.

Press the SHIFT key and the disc simultaneously to separate the gates. Press the right side of the disc to move the right gate away from the left; press the left side of the disc to bring them closer together. Beeps sound when limits are reached.

Illumination

Press the HIGH key to increase lamp intensity; press the LOW key to reduce intensity. When limits are reached, the system beeps. (When the MEASURE key is pressed, the instrument automatically adjusts illumination and the manual controls are inoperable.) When the measurement is completed the illumination is returned to the operators value.

SYSTEM DESCRIPTION

Operator Control Keyboard

Main Menu

The MAIN MENU key may be pressed anytime. Doing so aborts whatever is taking place and proceeds directly to the main menu.

Numeric Entries

The numeric keys are used to make required entries.

Clear

The CLEAR key clears a field or deletes the last character entered. It can also be used to clear a measurement.

Enter

The ENTER key tells the computer to accept the currently displayed entry. After making an entry, press ENTER. If a mistake was made on a prior line, keep pressing ENTER to move the cursor to the appropriate line (it will move down the screen then wrap around the top), then make the correction.

Measure

Press the MEASURE key to obtain measurements. This key only works when a video image is being displayed with the gates.

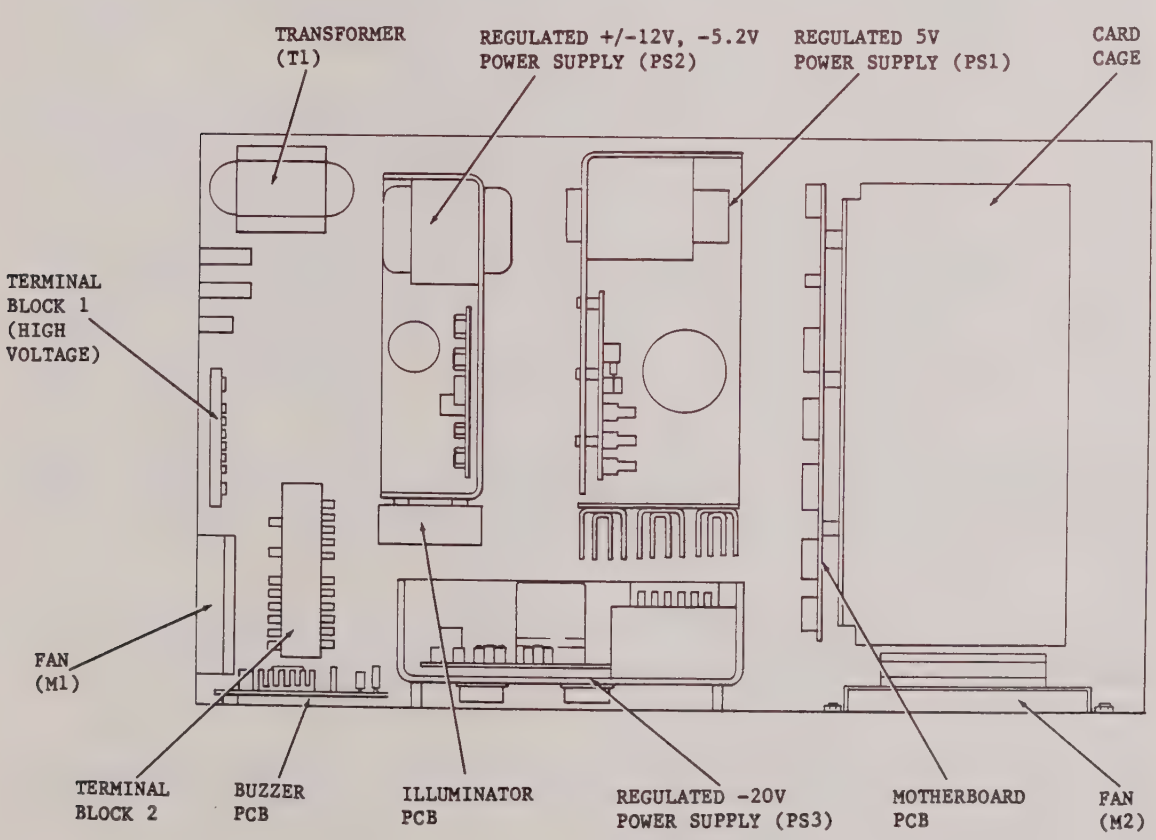
Hardware

The keyboard includes a connector where a full alphanumaric keyboard can be attached. When attached, it adds the capability to make alphabetic and numeric entries in certain fields, but otherwise does not affect instrument operation.

SYSTEM DESCRIPTION

System Electronic Control Module

The system power supplys (PS) and electronics are contained in the electronics control module, and are accessible by removing the top panel from the rear. The main power (110VAC) input first goes to TB1 (refer to the figure below). AC power is distributed from TB1 to a regulated 5V PS (PS1), a regulated +/-12V, -5.2V PS (PS2), a regulated -20V PS (PS3), a 16VAC transformer (T1), and two muffin fans (M1 and M2).



AC power from T1 is sent to the buzzer PCB. DC power from PS3 is sent to the illuminator PCB. DC power from PS1 and PS2 is sent to TB2. From TB2, DC power is distributed to the PCBs in the VLS card cage through the motherboard. The card cage contains five PCBs (excluding the motherboard PCB): (from top to bottom) A/D converter PCB (blue retainer clips), CRT controller PCB (yellow retainer clips), processor PCB (white retainer clips), I/O PCB (black retainer clips), and interface PCB (red retainer clips).

System Electronic Control Module

A/D Converter PCB

The A/D converter PCB is located in the first (top) slot of the card cage, and can be identified by the blue retaining clips. This PCB converts the analog signal from the camera to a 6-bit digital value at a 40-MHz rate, and temporarily stores the data for the CPU. The determination of where and how much of the signal is to be digitized in the X-direction is done on this PCB, and the signal is gated with the Y-direction (vertical) enable signal (MON and M ROW) from the CRT controller PCB. The A/D converter PCB will store a maximum of 8k bytes of data. When the memory is filled, a signal is generated (4KCRY) that terminates the operation and sends an interrupt to the VLS processor PCB via the CRT controller PCB.

The compliment of the horizontal starting point to be digitized is loaded into the horizontal delay counters (10D, 9D, and 10E). If the counter is enabled (MON signal from the CRT controller PCB) it runs at a 20-MHz rate until the counter overflows, which generate the horizontal drive signal (PPCRY). The overflow stops this counter and enables the horizontal width counter (8D, 7D, and 6D). This counter represents the width of data to be digitized; which is the distance between the gates on the monitor. This counter, in turn, runs until an overflow occurs (EODL signal), similar to the horizontal delay counter. Both of the above counters are reloaded during every horizontal retrace but only start if the MON signal is present from the CRT controller PCB. The enable to the horizontal width counter also enables the memory address counter (5E, 4E, and 3E). This increments the memory address to the high-speed RAM. Note that the address counter increments at a 20-MHz rate, but the A/D converter PCB runs at a 40-MHz rate. To compensate for this, each memory address holds two A/D bytes (one in each memory bank), and is organized in words.

The processor CPU gains access to the high-speed RAM by forcing its address into the memory address counter with the LDMA signal. This signal (D0000 HEX) is generated when the A/D converter PCB decodes a read request in its memory space.

The video signal from the camera is sent to the PCB where it is amplified by operational amplifier (op amp) 14A prior to entering the A/D circuitry. This amplifier serves two purposes.

a. To change the video amplitude from a 0.7 to 2.1 volts, to match the A/D reference settings.
b. To buffer the signals, and to act as a driver for the A/D input.

The video signal is mixed with the digital data from the CRT at op amp 17A. The signal is then buffered by op amp 17B, and sent to the CRT. This provides the ability to superimpose the measurement gates on the video image or any other data. The diodes around 17A limit the swing of the amplifier to 2.80 so it does not saturate. This ensures that the digital data intensity is not dependent on the video signal level.

SYSTEM DESCRIPTION

System Electronic Control Module

CRT Controller PCB

The CRT controller PCB is located in the second slot of the card cage, and can be identified by the yellow retaining clips.

The generator device (13B) provides the vertical and horizontal retrace to the camera. Another generator device (13C) provides the vertical and horizontal retrace for the monitor. The retrace is synchronized with the camera's vertical and horizontal retrace but with a 1.6-microsecond delay.

Only the video signal around the center of view of the camera displays on the monitor. The upper portion of the video signal is cut off by a latch and two counters (11F, 12F, and 13F, respectively). The lower portion of the video signal is cut off by the same two counters and another latch (6F). The Lower portion cut-off is automatic because this circuit also controls the video signal to the monitor.

Whenever the microprocessor tries to write or read to the CRT, gates 1D, 2F, and 6A should be enabled. The counters (5F and 6E) divide horizontal lines into 512 pixels, and two other counters (1E and 1F) divide the vertical lines into 512 pixels. This provides a total of 512 X 512 bits of memory for the monitor. The processor is capable of addressing any bit on the monitor through the multiplexer 2E, 3E, 4E, and 5E.

The dynamic RAM controller (3D) receives the memory address from the multiplexer and generates the appropriate signal for the dynamic RAM (16 D2118-3 chips at 5B through 12B and 5C through 12C). The dynamic RAM has 16K x 16 bits of memory. The dynamic RAM data is transmitted to the monitor by the shift register (6D and 11D).

The are three signals for controlling the data collection:

- Measure On (MON) -- The complement of the numbers of horizontal lines that start to collect data is loading two counters (11E and 10E). Their overflow triggers latch 12E that signifies the start of the measure area.

- Measure Row (M ROW) -- Counters 7E and 8E determine the number of lines of data to collect. This number is preloaded by the VLS processor PCB.

- Data Ready Interrupt (DRI) -- Counter 9E sends an interrupt to the microprocessor when 8K-memory of data on the A/D PCB is full, or the collection of the desired number of horizontal lines are obtained, so the microprocessor can stop collection data.

System Electronic Control Module

Processor PCB

The processor PCB is located in the third slot of the card cage, and can be identified by the white retainer clips.

The Central Processing Unit (CPU) for the PCB is the Intel 8086-2 Microprocessor, operating at 8 MHz. The CPU includes four 16-bit memory base pointer registers, and two 16-bit index registers. All registers are accessed by a total of 24 operand addressing modes for memory addressing and for high-level language and assembly language data structure support.

On-board timing for the CPU is provided by an 8284A Clock Generator device (U4). This device generates a 8-MHz clock output for the CPU clock input. The RESET and READY functions for the CPU are also generated by the 8284A device.

Another timing circuit, consisting of a crystal oscillator and two 4-bit counter devices, generates clock signals for the 8253-5 Programmable Interval Timer (PIT). The circuit produces the BCLK/ and CCLK/ multibus clock signals and the MCLK/ bus clock signal at a frequency of 9.83 MHz. The PIT generates timing for the serial port (RxC and TxC baud rate clock), and inputs to the interrupt controller.

The processor PCB contains 16 2164-RAM devices with 128K bytes enabled as a dual port RAM. The local address of the dual port RAM for the processor PCB is 00000H through 1FFFFH (128k bytes). The size and ending address of the dual port RAM is defined by a 3625 decode PROM (U66).

The dual port control logic interfaces the RAM with the multibus interface and the on-board bus. This allows the multibus interface resources to access the dual port RAM when not in use by the processor PCB. The dual port logic consists of CPU address and data buffers and decoders, bidirectional address and data bus (multibus interface) drivers, slave RAM address decoder/translater, control logic, and the RAM array.

The processor PCB has four 16K by 8-bit 27128 EPROM devices (U39, U40, U57, and U58). The EPROM addressing is F0000-F7FFFH for U39 (low odd) and U57 (low even), and F8000-FFFFFH for U40 (high odd) and U58 (high even).

When the CPU issues an address it also outputs three status bits (S0, S1, and S2) that are latched by the on-board 74S373 octal three-state buffer. This generates the MEM/IO signal to indicate whether the address should be examined by the memory decode circuitry or by the I/O decode circuitry. When MEM/IO is a "1", the memory decode circuitry (devices U45 and U46) is enabled; conversely, when MEM/IO is a "0", the I/O decode circuitry (device U36) is enabled.

System Electronic Control Module

When enabled, the programmable array logic (PAL) devices U45 and U46 decode the address input to activate one of the RAM or EPROM chip select signals for the memory array. The PAL device U36 provides the address decode that generates chip select terms for the bus interface, for the status register, and for each of the LSI devices on the PCB, including the 8255A PPI, the 8253-5 PIT, the 8259A PIC, and the 8251A PCI device.

The I/O decode circuitry consists of PAL device U36, and logic gates U13, U16, U29, U53, and U59. The I/O decode circuitry examines address lines A0 and A3, A4, A5, A6, and A7-AF to determine if the address is a valid on-board I/O address and to enable the proper chip select signal.

The processor PCB contains a PIT (U37) that has three software selectable counters. The input frequencies are determined by the jumper selections described below:

Counter	Frequency	Jumper
Clock 0 input	1.23-MHz	E175-E184
Clock 1 input	153.60-MHz	E184-E185
Clock 2 input	1.23-MHz	E178-E179

The processor PCB uses an 8251A Programmable Communications Interface (PCI) device (U38) to handle serial communications through connector J2. The complete functional definition of the PCI is programmed by system software.

There are eight programmable parallel I/O lines implemented with a single 8255A Programmable Peripheral Interface (PPI) device (U35). The lines are grouped into a software programmable 8-bit I/O port.

The interrupt circuitry consists of an interrupt source jumper matrix, an 8259A Programmable Interrupt Controller (PIC) at U34, and the interrupt acknowledge logic. The PIC handles up to eight bus or nonbus vectored priority interrupts.

The processor PCB contains an 8203 Dynamic RAM Controller (U72) that provides multiplexed addresses, address strobes, and refresh/access arbitration for the on-board RAM array. The memory refresh cycles are internally requested and generated by the device. In response to chip select terms and an address, the controller generates the ROM address select signal (RAS/), the COLUMN address select signal (CAS/), and the 8-bit cell address required to access the memory array during READ, WRITE, and REFRESH operations.

System Electronic Control Module

I/O PCB

The I/O PCB has three primary functions:

- Provides RS-232 serial communications,
- Provides expanded memory of up to 64K words, and
- Provides autoblacking for the camera.

The system program expansion is located on four PROMs at locations 6C, 7C, 9C, and 10C. Data to the PROMs is buffered by three buffers (8E, 9E, and 10E). The system memory is jumper selectable (W2) for 32K or 64K bytes. There are three address buffers (5C, 6E, and 7E) for the memory expansion.

Two decode devices (4C and 4E) are used for address mapping the different functions of the I/O PCB.

A timer (12C) is used to select the baud rate for the serial asynchronous communications (USART) (at 13C) according to instructions from the processor PCB. The USART is used for external communications from the processor PCB to a host. A clock at location 11A runs the timer.

The two drivers at 13E and 14E are for receiving and transmitting RS-232 communications, respectively. The three devices at 14B, 15B, and 16B act as buffers for the parallel port (15C) to the PRU.

All data for the timer, USART, and parallel port first goes through a bidirectional buffer at location 12C.

The autoblacking circuit is a state machine that provides the programmable black level referencing to the camera. The processor PCB determines which camera tube area is to be used for the reference, and sends a signal (MTC) to the camera through the autoblacking circuit. The operation PROM at location 11C directs the state machine. The processor PCB addresses the operation PROM through the address decoders (4C and 4E) and a latch (10A), and commands which operation program to follow. Data from the processor PCB to the operation PROM is buffered at 11E.

The vertical (VRTRIB) and horizontal (HRTD) retrace pulse signals are synchronized by flip-flops 16E (2) and 16C (2), respectively. When the processor PCB communicates with the autoblacking circuit, it generates a MTSEL signal that is synchronized by flip-flops 16C (2).

The mapping PROM (6A) for the autoblacking circuit defines the operation state changes. The units at 6B and 7A are latches for the mapping PROM. The units at 9A and 8B are latches for the two PROMs (8A and 7B) the contain the state machine programs and the possibilities for different states of operation.

Following a change in the operation state, three latches (9B, 10B, and 12B) force the operation PROM to return to the set operation program. Input to the three latches is buffered at 11B. The output of the MTC signal to the camera can be measured at J47.

System Electronic Control Module

Interface PCB

The interface PCB is located in the fifth slot of the card cage, and can be identified by the red retaining clips.

The battery back-up C-MOS is a byte-wide random access memory (RAM) located in 4B, 5B, 7B, and 8B. The system can accept 2K by 8-bit or 8K by 8-bit, depending on the configuration jumper located on 6D. The standard system uses 8K by 8-bit; jumper configuration 6D and 3A provide for the 8K switch bank.

The power failure protection circuit is located in 14A, 15A, 17A, 16B, and 17B. The circuit monitors AC and disallows access to the C-MOS RAM if the main power supply decreases below the safe operation level (5% of nominal). It does this by generating a power fail interrupt to the main processor within 1/4 of an AC cycle (worst case). The main processor can read the status of C-MOS memory when bit 0 of status byte 10D is low (TTL 0). This is an indication that C-MOS is not available for use.

The electrically-programmable memory is a byte-wide memory 2K by 8-bit located in 9B, where the system calibrations are stored. This circuit features a write protection to prevent sporadic writing, especially during a power failure or a power recovery period.

The asynchronous serial communications interface circuit is located in 11B, 12B, 12C, 10A, 13A, and 17D. It is used to generate RS232C standard communications signals to drive the printer. The circuit features programmable baud rate from 110 to 9600, and generates an interrupt to the main processor any time service is required.

The keyboard scanning circuit is located in 13E, 14E, 15E, 16E, 17E, and 17D. It generates and debounces all the key codes required when any key from the keyboard or alphanumeric keyboard is pressed. The main processor reads the keyboard buffer 13E on a program schedule basis. Data bit 7 is used as a data stable indicator. If data bit 7 is 1 (TTL high) it is an indication that the keyboard data is not stable, then the processor reads the keyboard again.

The autoillumination circuit consists of 12E illuminator buffer that is the source for an eight-bit latch in the illuminator PCB. The eight bits generate a proportional 0 to 12 volts to drive the 50-watt illuminator lamp.

The diagnostic LED circuit is located in 5A, 6A, 7A, and 8A, and includes 16 LEDs at the center edge of the PCB. The function of these LEDs are to visually indicate the status of the data bus at some prespecified time, some of its applications are explained in the Diagnostics Section.

System Electronic Control Module

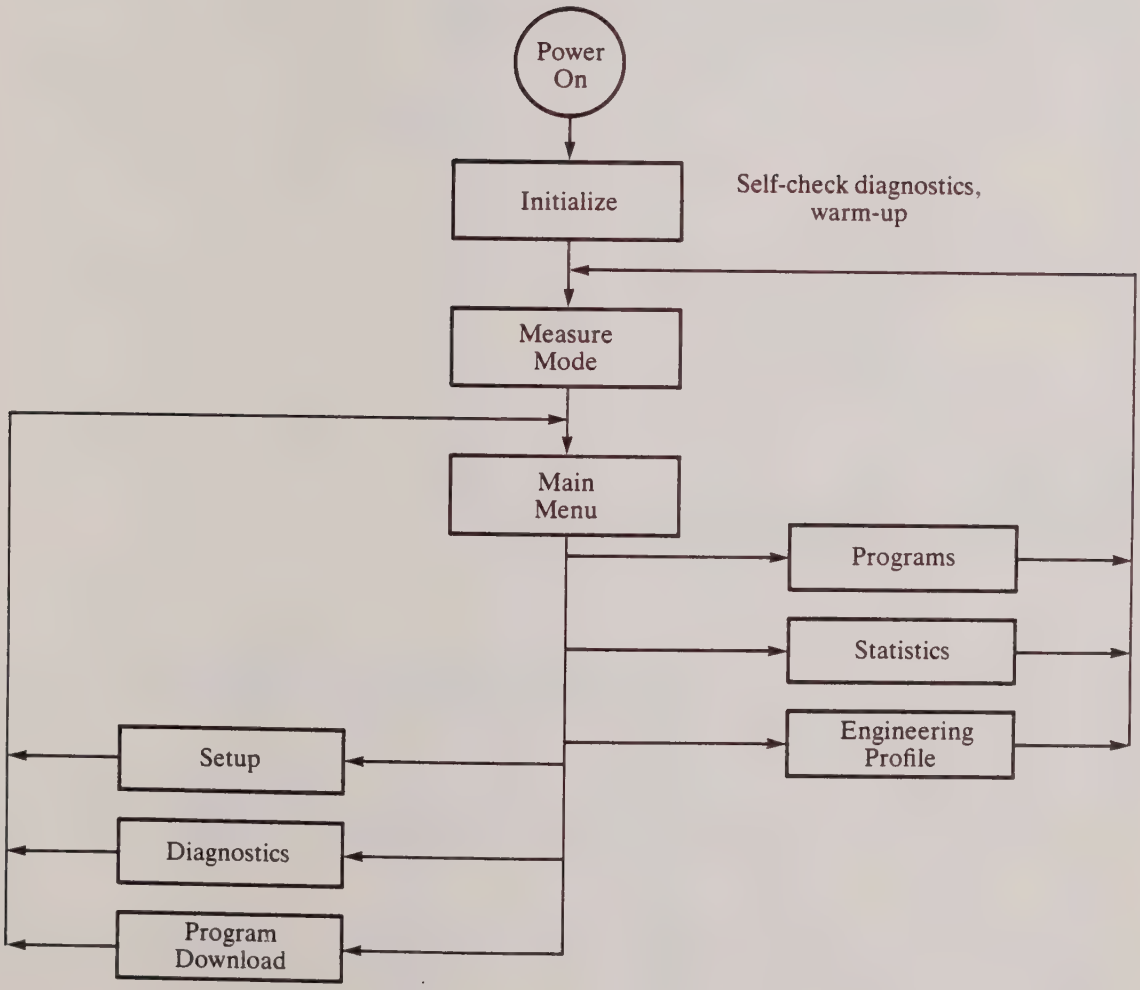
The configuration switch circuit is located in 9A, 4A, SW1, and SW2. These switches, when read selected by the main processor, will present a bit pattern to the data bus depending on the condition of the bit switches. If open, the bit is 1 (TTL high). Its use is explained in the diagnostics (switch configuration) Section.

The buzzer circuit is located in 12A and driver Q3. This circuit is used to generate an audible signal to indicate inappropriate inputs or illegal output conditions. The buzzer is turned on when the main processor selects a specific even byte.

The support circuits consist of PROMS 4D and 5D. They are used to generate all the select signals for each device on the PCB. The acknowledge circuit consists of 1C, 2C, 3C, 1D, 2E, and Q9. It is used to generate a respond signal required by the main processor when it selects a device in the PCB. The address, data bus buffers, and select circuit are located in 3E, 4E, 5E, 6E, 7E, 8E, 9E, 1D, 2D, and 3D. This circuit is used to isolate the address bus and timely select the data bus and its direction.

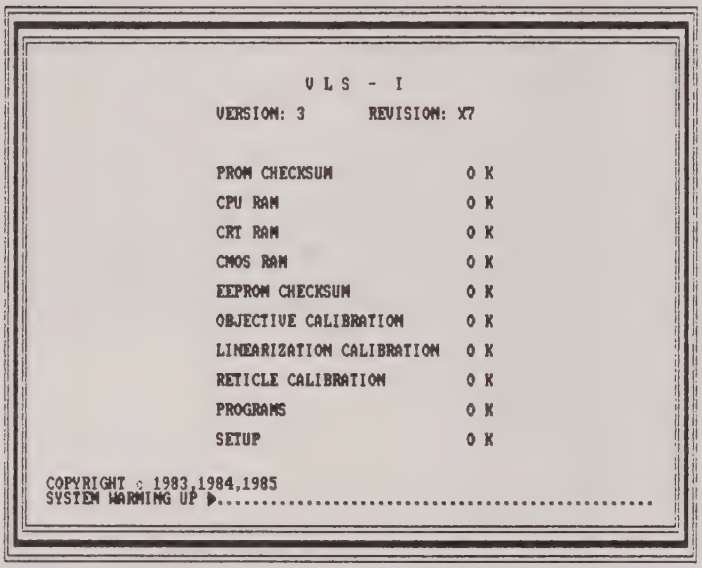
THEORY OF OPERATION

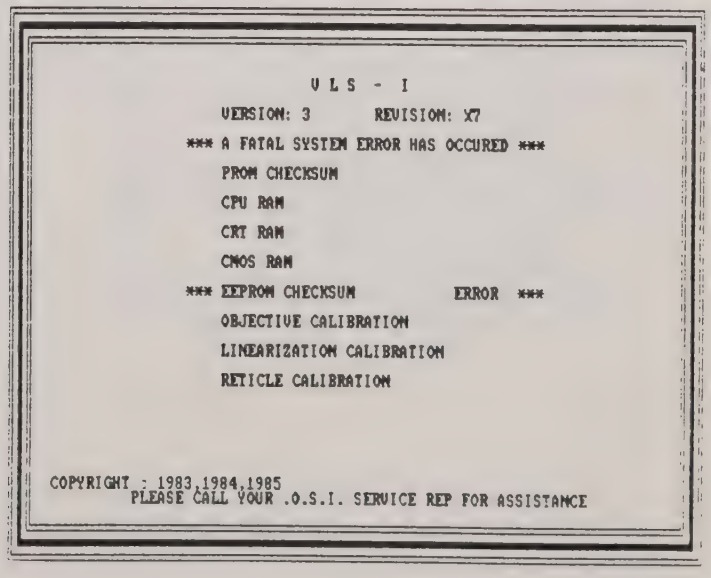
How the VLS-I works can be conceptualized with the help of this block diagram.



THEORY OF OPERATION

When powered on, the system initializes and performs diagnostics checks to confirm that all is in working order. Instrument calibrations, set-up parameters, and stored user programs are examined by means of checksum comparisons to be sure no memory loss has occurred. If a problem has developed, the instrument will not continue.





THEORY OF OPERATION

After a brief warm up, the instrument cycles to the measure mode where linewidth measurements can be made. Wait 15 minutes before taking measurements.

The operator interface with the VLS-I is the keyboard. With the keyboard, the measurement gates are positioned, illumination is controlled, and entries can be made to identify the sample being measured and the measurement program to use.

To take measurements, place the target feature centered inside the brackets defining the allowable measuring area and position the measurement gates on either side of the feature. The keyboard's disc positioner controls gate placement, height, and separation: at 100X, gate height can be varied from 0.3um (for measuring small features) to 20um (for measurements on grainy edges). Gates can be separated approximately 22um.

Information between the gates is digitized at 40 MHz to obtain a digitized profile of the feature being measured. This real-time profile is displayed at the lower left of the CRT. Each digitized pixel represents approximately 0.025um in the X-direction and 0.055um in the Y-axis.

When the MEASURE key is pressed, the area between the gates is scanned and the microscope's illumination is automatically adjusted. Lamp intensity is computer-controlled to assure a machine-repeatable profile. The light is adjusted to the maximum level that does not cause the A/D to overflow this assures maximum signal level.

When the MEASURE key is pressed, automatic focus also begins (if programmed for autofocus): microfocus automatically analyzes the slope of the optical profile, and drives the piezo-stage until the "slope" is maximized. Repeatability of the focusing mechanism is 0.05um.

When optimal illumination is achieved and focus adjusted, the feature is scanned to obtain an average measurement over the height of the gates. The resulting linewidth is displayed at the lower right of the CRT. For measurements in the Y-direction, rotate the detection assembly. The rotator permits 90-degree rotation with detents at the end points for rapid switching between vertical and horizontal measurements.

The system automatically checks a self-calibration reticle in its optical path to assure long-term stability. (The brackets that define the measurement area on the CRT are the image of this reticle.) In addition, the area between the brackets is segmented and calibrated to assure linearity within the measurement area. This results in reproducible measurements less dependent of feature placement.

The system is factory-calibrated for all objectives supplied with it.

THEORY OF OPERATION

By pressing the yellow MAIN MENU key, you can call up the main menu which lists all instrument modes. From some of these (programs, statistics, and engineering profile) you may return directly to the measure mode. Other modes (set up, diagnostics, and program download) require first returning to the main menu, then going to the measure mode.

Each of the modes offers a choice of functions that can be performed in that mode. Some functions require a password.

Up to 60 password-protected user programs can be stored in battery-backed RAM. Programs include measurement method (1-6), objective to be used, thresholds (left and right independently variable from 0 to 100%), gate height and separation settings, measurement units, focus method, engineering measurement limits, and calibrations to user's in-house standards. A listing of stored programs is displayed when selecting programs from the main menu. Any program's parameters may be viewed by selecting that program's ID. Alterations or deletions of a program or its statistics require password access.

Statistics reports the number of readings, mean, standard deviation (1 and 3 sigma values), and the range of measurements obtained. Statistics are cumulative for the program; a separate set of statistics is maintained by sample number.

Special Operation Notes:

1. To provide you with as much feedback as possible, the VLS-I will beep if it does not understand or cannot execute your entries. Where helpful, an explanation for the beep appears at the lower right of the CRT.

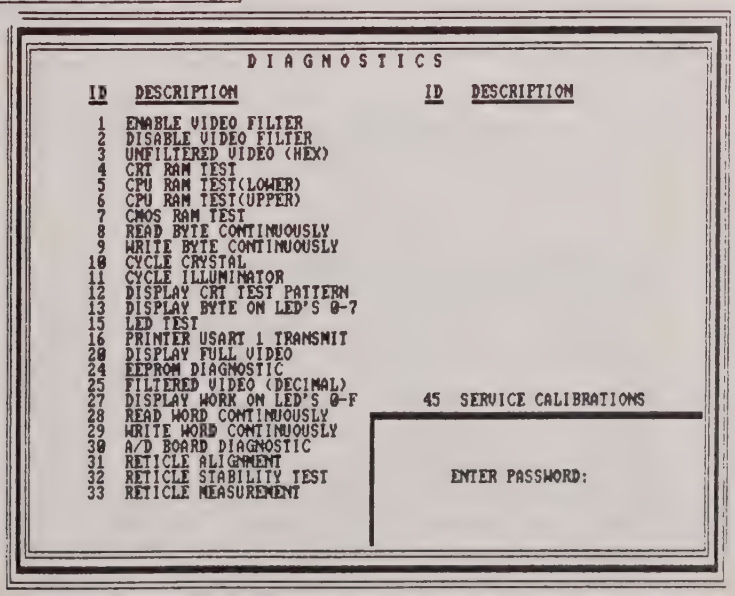
2. There is a reset switch on the electronics control module. This is a hardware reset and halts whatever is taking place, returning the instrument to the beginning of the program routines.

3. Pressing the MAIN MENU key also aborts whatever is taking place, and is less drastic than reset. If you ever become lost, pressing the MAIN MENU key will return you to the main menu screen.

DIAGNOSTICS

> **CAUTION**
>
> The use of these diagnostics by untrained personnel can result in system damage...Consult OSI Field Service for training information.

To enter the DIAGNOSTICS mode, verify that the Main menu is displayed, if not press the MAIN MENU key on the keyboard. Enter 5 - DIAGNOSTICS for the selected mode. The diagnostics menu will be displayed and the system prompts for the password. Once the password has been entered any of the displayed diagnostics can be performed by entering the selected diagnostic number.



DIAGNOSTICS

Diagnostics for the VLS-I system are described in this section of the manual.

1 - ENABLE VIDEO FILTER: Sets real-time profile to display filtered video data.

2 - DISABLE VIDEO FILTER: Sets real-time profile to display the first line of the unfiltered video data.

3 - UNFILTERED VIDEO (HEX): Displays on the CRT the the unfiltered video data base in hexadecimal form 00H to 3FH.

4 - CRT RAM TEST: Tests the CRT RAM with a walking one (1) and a walking zero (0) from C0000H to C7FFEH. The screen is initially cleared.

5 - CPU RAM TEST (LOWER): Tests the CPU RAM from 00000H to 0FFFEH with a walking one (1) and a walking zero (0).
NOTE !!!MEMORY IS DESTROYED!!!

6 - CPU RAM TEST (UPPER): Tests the CPU RAM from 10000H to 1FFFEH with a walking one (1) and a walking zero (0).
NOTE !!!MEMORY IS DESTROYED!!!

7 - CMOS RAM TEST: Tests the CMOS battery backed-up RAM from B0000H to B3FFFH, if 16K of RAM, with a walking 1 and 0. If 32K of RAM the test is from B0000H to B7FFFH. To exit, press ENTER. MEMORY IS NOT DESTROYED.
NOTE DO NOT RESET OR POWER DOWN DURING THIS TEST OR MEMORY WILL BE DESTROYED!!!

8 - READ BYTE CONTINUOUSLY: After the binary address is entered the byte at that address will be continuously displayed on the CRT.

9 - WRITE BYTE CONTINUOUSLY: After the binary address and the binary word is entered, that binary word will be continuously written.
NOTE DO NOT USE THIS DIAGNOSTIC ON EEPROM ADDRESS.

10 - CYCLE CRYSTAL: After the delay time, step size, upper limit, and lower limit are entered, the crystal will start at the lower limit then step up the step size after the entered time delay. When upper limit is reached the cycle will reverse and the crystal will be stepped down to the step size after the entered time delay. If the next step would be beyond a limit then the step is only to that limit. If zero (0) time delay is entered then only a step position is entered and the crystal will move to that position. This Diagnostic is used to set crystal adjustment, check crystal movement, & range.

11 - CYCLE ILLUMINATOR: After the delay time, step size, upper limit, and lower limit are entered, the illuminator will start at the lower limit then step up the step size after the entered time delay. When upper limit is reached the cycle will reverse and the illuminator will be stepped down the step size after the entered time delay. If the next step would be beyond a limit then the step is only to that limit. If zero (0) time delay is entered then only a step position is entered and the illuminator will illuminate at that value.

12 - DISPLAY CRT TEST PATTERN: The CRT is written with concentric rectangles filling the whole screen. Press the ENTER key to return to diagnostic menu.

13 - DISPLAY BYTE ON LED'S (0 - 7): After the binary address is entered the byte at that address will be continuously displayed on LED's 0-7 where bit 0 through bit 7 are displayed on LED 0-LED 7 respectively.

15 - LED TEST: All LEDs are turned on. Press the ENTER key to return to the diagnostic menu.

16 - PRINTER USART 1 TRANSMIT: When this diagnostic is selected "U"s will be sent to the printer.
NOTE THE PRINTER INTERRUPT IS NOT USED WHEN SENDING "U"S TO THE PRINTER.

20 - DISPLAY FULL VIDEO: The CRT is completely filled with the video image and a cross is displayed in the center of the video image. Press ENTER to return to the diagnostic menu. This diagnostic is used when centering the camera in the microscope.

24 - EEPROM DIAGNOSTIC: The EEPROM write cycle time is checked for being within proper limits and the current number of writes to the EEPROM is displayed. Press ENTER to return to diagnostic menu. Running this Diagnostic may correct an EEPROM checksum error.

25 - FILTERED VIDEO (DECIMAL): Displays on the CRT the filtered video data base in decimal from 0 to 2016.

27 - DISPLAY WORD ON LED'S (0 - F): After the binary address is entered, the word at that address will be continuously displayed on LEDs 0-F where bits 0-F are displayed on LED 0-F, respectively.

28 - READ WORD CONTINUOUSLY: After the binary address is entered, the word at that address will be continuously displayed on the CRT.

29 - **WRITE WORD CONTINUOUSLY:** After the binary address and the binary word is entered, that binary word will be continuously written.
NOTE THE LEAST SIGNIFICANT 8 BITS WILL BE WRITTEN TO THE BINARY ADDRESS ENTERED AND THE MOST SIGNIFICANT 8 BITS WILL BE WRITTEN TO THE BINARY ADDRESS ENTERED PLUS ONE (1).

30 - **A/D BOARD DIAGNOSTIC:** This is for Engineering and manufacturing use ONLY.

31 - **RETICLE ALIGNMENT:** The CRT displays a rectangle that the reticle is aligned to. Press the ENTER key to return to the diagnostic menu.

32 - **RETICLE STABILITY TEST:** The CRT displays the RETICLE DIMENSION LOG, that measures the stability of the reticle. Press the ENTER key to return to the diagnostic menu.

33 - **RETICLE MEASUREMENT:** Allows the operator to measure autocompensation reticle, and accept or reject any measuement. Press the ENTER key to return to the diagnostic menu.

45 - **SERVICE CALIBRATIONS:** This is for Field Service and manufacturing use ONLY.

LED Status

The LEDs on the interface PCB can be used as aids for diagnostics. Their status when lit is described below.

0 = PROM checksum error
1 = CPU RAM failure.
2 = CRT RAM failure.
3 = CMOS RAM failure.
4 = EEPROM failure.
5 = Objective calibration checksum error.
6 = Linearization calibration checksum error.
7 = Reticle calibration checksum error.
8 = N/A.
9 = N/A.
A = N/A.
B = N/A.
C = N/A.
D = N/A.
E = N/A.
F = N/A.

Switch Configuration

Switch positions SW1 and SW2 on the interface PCB are read by the main processor, and can also be used as aids for diagnostics. The switch settings are described below.

1. SW1

0 = (On) Power up--go directly to diagnostics;
(Off) Do not go to diagnostics.
1 = (On) If going directly to diagnostics, load PROM program into buffer;
(Off) Do nothing.
2 = N/A.
3 = (On) Black Clamp between the gates all the time;
(Off) Black Clamp only during measurement.

Below Version 20 software --
4 = N/A.

For Version 20, or higher software --
4 = (On) Enable Histogram;
(Off) Disable Histogram.
5 = N/A.
6 = N/A.

Prior to Version 3, Revision 8 software.
7 = N/A.

For Version 3, Revision 8 or higher software --
7 = (On) If switch 0 is also ON, the EEPROM reticle table pointer is initialized.
(Off) Nothing.

2. SW2

8 = (On) VLS-I is connected to an inspection station;
(Off) VLS-I is a stand-alone system.
9 = (On) The inspection station is a MV-7 or MV-10;
(Off) The inspection station is a MV-15.
A = N/A.
B = N/A.
C = N/A.
D = N/A.
E = N/A.
F = N/A.

PREVENTATIVE MAINTENANCE

This section contains procedures for daily, weekly, monthly, and quarterly maintenance checks. Recommended adjustments are described in the Adjustments section.

Note: The VLS-I is a highly sophisticated system. Every care was taken in its assembly and testing to ensure a high level of quality. Nevertheless, it is not maintenance free, and proper maintenance is vital to obtain effective use. Untrained personnel should not work on this system. Training from OSI is available at no charge during the warranty period. If training has not yet been provided, please call OSI Field Service at (415) 490-6400.

Daily

CAUTION
Do not use acetone as a cleaning solution. When cleaning the eyepieces, do not use excessive cleaning solution. Moisten cloth or swab lightly to avoid having solution run. Excess could result in the loosening of cement on interior surfaces.

- Clean the eyepiece optical surface, and all contact surfaces with methanol, isopropyl alcohol, or a mild cleaning solution on a lint-free cloth or cotton swab.

Weekly

Perform the checks and adjustments listed below. The adjustment and detailed check (*) procedures are described in the Adjustments Section.

- Check the transmitted illumination and adjust if necessary.*
- Check the transmitted illumination field diaphragm for centering and adjust if necessary.*
- Check the transmitted illumination aperture diaphragm ring for smooth movement.
- Check the field diaphragm, in reflective lighting, and adjust if necessary.
- Check that the microscope illuminator bulb is centered, and adjust if necessary.*

PREVENTATIVE MAINTENANCE

Weekly

- Check the video camera for center rotation, and adjust if necessary.*
  1. Load a wafer onto the stage and bring it into view.
  2. Enter **5–DIAGNOSTICS** from the Main menu and select Diagnostics **31–RETICLE ALIGNMENT.**
  3. Using the 100X objective, move the stage until the small "+" is centered on a feature.
  4. Use the image rotator to rotate the camera 90-degrees with respect to the microscope.
  5. Verify that the small "+" is still centered on the feature.
  6. If the "+" is not centered, use the three camera lockdown screws to adjust the camera so that when the image rotation is switched the "+" remains centered on a feature.
  7. Press the **ENTER** key to return to the Diagnostics menu, or press the **MAIN MENU** key to return to the Main menu.

- Check the video camera for reticle alignment, and adjust if necessary.*
  1. Load a wafer onto the stage and bring it into view.
  2. Enter **5–DIAGNOSTICS** from the Main menu and select Diagnostics **31–RETICLE ALIGNMENT.**
  3. Using the 100X objective, move the stage until a blank area of the wafer is in view.
  4. Verify that the black reticle brackets are aligned to the white rectangle.
  5. If the reticle is not aligned, loosen the three reticle lockdown screws and align the reticle.
  6. Once the reticle is aligned tighten the lockdown screws.
  7. Press the **ENTER** key to return to the Diagnostics menu, or press the **MAIN MENU** key to return to the Main menu.

- Check for dirt within the reticle area, and clean if necessary.

- Check the piezo crystals on autofocusing stage per diagnostic #10.
  1. Load a wafer onto the stage and bring it into view.
  2. Enter **5–DIAGNOSTICS** from the Main menu and select Diagnostics **10–CYCLE CRYSTALS.**
  3. Enter: STEP RATE = 0
STEP SIZE = 0
  4. At 100X, focus the field diaphragm on the center of a wafer. Note the position of the stage from the markings on the fine focus knob.
  5. Enter: STEP RATE = 0
STEP SIZE = 1023
  6. Refocus the field diaphragm. The total stage travel, as measured by the numbers on the fine-focus knob, should increase 40–50um, as the stage lowers, and adjust if necessary.*
  7. Press the **ENTER** key to return to the Diagnostics menu, or press the **MAIN MENU** key to return to the Main menu.

PREVENTATIVE MAINTENANCE

Monthly

- Check that the fans on the control box are working.
- Check the X-Y stage movements.
- Check the power supply (PS) voltages, and adjust if necessary.*

  There are three adjustable PSs in the VLS-I electronics module: a regulated 5V PS (PS1), a regulated +/-12, -5.2V PS (PS2), and a regulated -24V PS (PS3). Remove the top panel of the module to gain access to the terminal blocks.

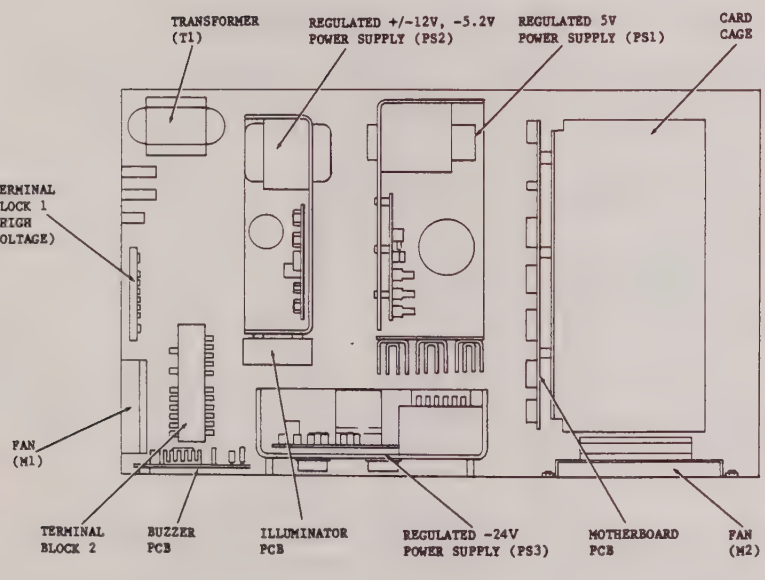


Figure A

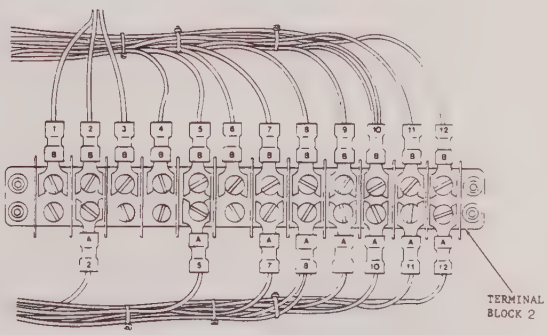
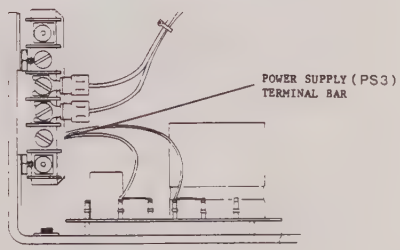


Figure B



PS1, PS2, and PS3 (refer to Figure A) supply 5V, +/-12V and -5.2V, and 20V to the VLS-I. Measure the voltages at TB2 for PS1 and PS2, and at the PS3 terminal bar for PS3 (refer to Figures A and B).

PS	Lead	Color	Voltage
1	2	Red	5
	5	Green	COM
2	8	Blue	12
	9	Brown	COM
	10	Orange	-12
	11	Red	COM
	12	Black	-5.2
3	Violet (-20V) and	Green (ground)	-20

PREVENTATIVE MAINTENANCE

Quarterly

- Check the wiring harnesses for broken or bare wires; check the wiring connectors -- make sure they are plugged in securely. Replace defective harnesses.

- Check the illuminator brightness control for proper illumination. Look through the microscope eyepiece, and adjust the illumination using the Illumination UP and DOWN keys on the keyboard. Verify that there are no dead spots (no light) in the adjustment range.

- Check the reflected light aperture diaphragm for centering, and adjust if necessary.*

- Check the objectives for centering, and adjust if necessary.*

- Check the objective parfocality. This procedure requires shims of 0.0005 and 0.001-inch thickness.

CAUTION
Objectives must be recalibrated after any adjustment in this area.

1. Objectives should be installed so that magnification increases as the turret is rotated to the clockwise. If this entails relocating any objectives already on the turret, remove any shims and save them for later use.

2. Load a wafer onto the stage and bring it into view at the highest magnification (or the objective with the longest length).

3. Bring the wafer into focus using the focus knob.

4. Rotate to the next lower power objective without refocusing and check the image. If it is out of focus, place shims of either thickness under this objective or under the highest power objective until the out-of-focus condition is corrected. (Note: the wafer may have to be moved out of the way to install the shims.)

5. Center any objective that was moved (refer to the Adjustments Section.

6. Calibrate any objective that was moved, had shims installed, or shims removed (refer to the Service Calibration Section.

ADJUSTMENTS

This section contains the adjustments necessary to maintaining the VLS-I in proper operating condition. Refer to the previous section for detailed information on using the diagnostics. If you have any questions, contact OSI Field Service at (415) 490-6400.

Electronics Control Module Power Supply

> WARNING
>
> Always use an insulated or other nonconducting screwdriver when adjusting PS voltages.

1. On PS1, turn the one potentiometer to obtain the correct reading.

2. On PS2, turn the appropriate potentiometers to obtain a correct or balanced reading. The top potentiometer is for +/-12V adjustments, and the bottom potentiometer is for -5.2V.

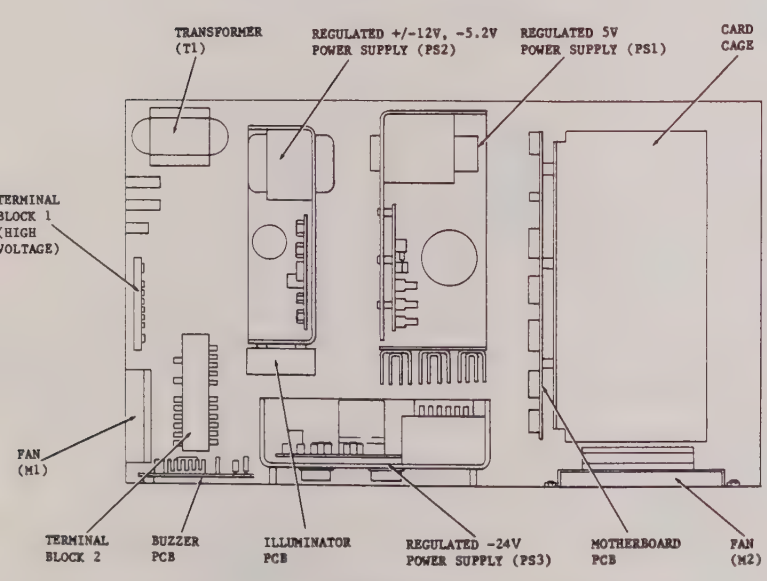


Figure A

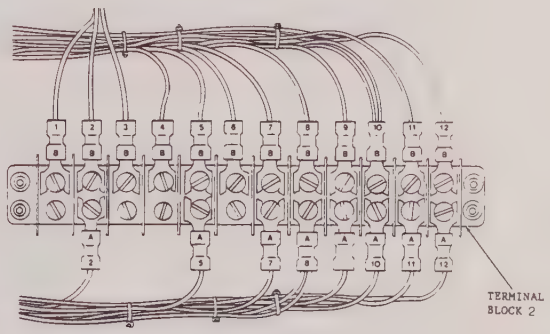
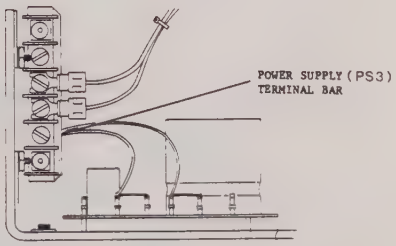


Figure B

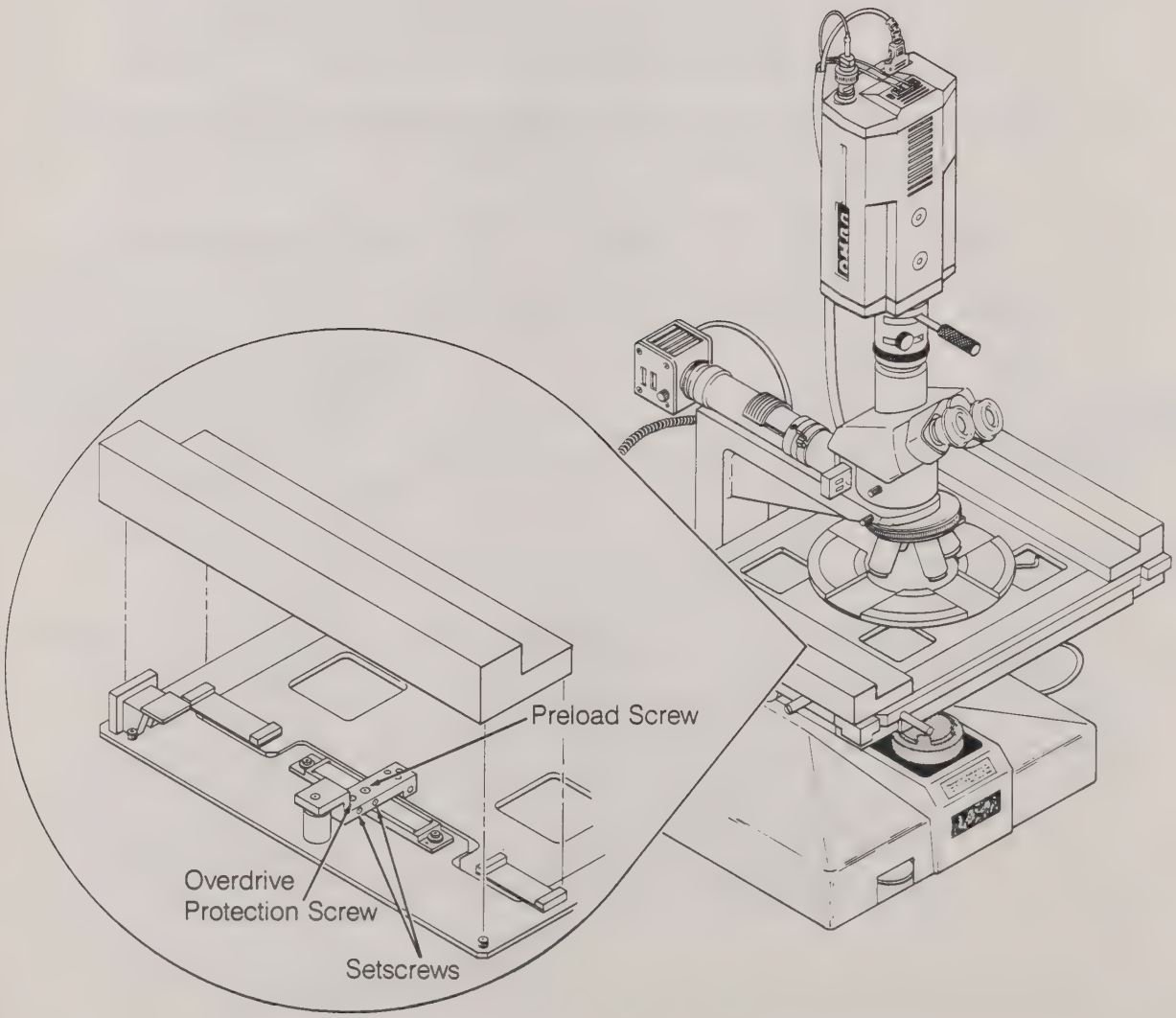


3. PS3 supplies -24V to the VLS-I. Measure the voltage at the PS3 terminal bar (refer to Figures A and B). The violet terminal lead is -20V, and the green terminal lead is ground. Adjust the voltage by turning the red potentiometer (labeled V. ADJ).

ADJUSTMENTS

Stage Preload

The piezo crystals driving the focusing stage are factory preloaded to assure proper contact. It is possible that the preload has shifted. Check first and adjust if needed.



Stage Preload

1. Remove the stage covers.

2. Back off the setscrews, overdrive protection screw, and preload screws until there is visible space between the screws and the tops of the crystals.

3. Enter **5-DIAGNOSTICS** from the Main menu and select Diagnostics **10-CYCLE CRYSTALS**.

4. Enter: STEP RATE = 0
   STEP SIZE = 0

5. Using the 100X objective, focus the field diaphragm at the 3 o'clock position on a 3" or 4" wafer.

6. Tighten the preload screw on the right side until the diaphragm just begins to defocus. This means the preload screw is just making contact on the top of the crystals.

7. Focus the field diaphragm at the 9 o'clock position on the wafer and tighten the preload screw on the left side until defocus just occurs.

8. Both preload screws are now just in contact with the tops of the crystals.

9. With the diaphragm in focus at the 9 o'clock position, lower the stage 15um using the numbers on the focus knob to determine the 15um movement. Then, tighten the preload screw to raise the focusing platform until the diaphragm is again in focus.

10. Repeat, starting with the diaphragm in focus at the 3 o'clock position.

11. The proper preload has now been applied at the left and right preload screws.

12. There are overdrive screws on each side of the stage. They prevent hitting the focus mechanism too hard--the overdrive screws take up the shock.

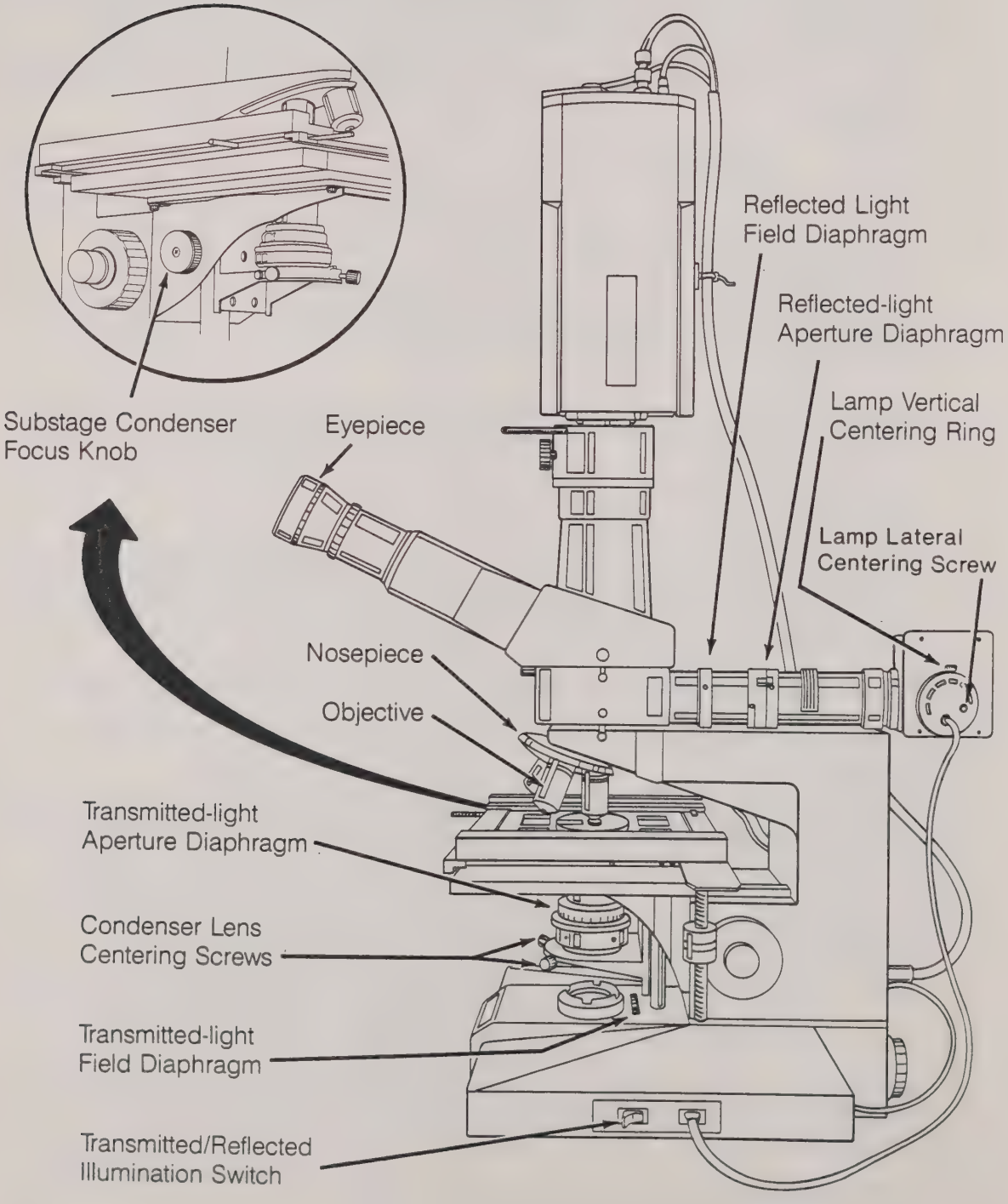
13. Once preload has been properly adjusted, adjust the overdrive protection:
    a. Focus the diaphragm again at the 3 o'clock position.
    b. Tighten the right overdrive screw until contact is just made, then back the screw off 1/8 turn.
    c. Repeat for the 9 o'clock position.

14. Check the piezo crystals on autofocusing stage per diagnostic #10, as described in the Preventative Maintenance Section, to verify proper adjustment.

15. Once the preload and overdrive have been properly adjusted, press the **MAIN MENU** key, to exit the Diagnostics mode.

ADJUSTMENTS

Microscope



ADJUSTMENTS

Microscope

Koehler-Type Illumination

A method to assure uniform specimen illumination is called Koehler illumination. It prescribes precise conditions under which the specimen and illumination are in correct adjustment simultaneously. It pertains to reflected and transmitted light; however, your microscope has all conditions permanently fixed for reflected light--adjustments need be made only for transmitted light. If this is a new procedure for you, make the following adjustments using first the 10X objective, since things are easier to see, then repeat the same steps with the 100X objective.

Note: **These adjustments should only be performed by OSI-trained service personnel.**

Centering Objectives (Parcentration)

Your microscope is equipped with objective-centering adjustments so that you center on a target when switching between objectives. The objectives have been centered at the factory but should be checked for proper centering anytime the camera or an objective is replaced.

1. Remove the nosepiece and invert it on a work table.
2. Remove the 10X objective. Using the nosepiece-centering tools, adjust the objective mount to the center of its range. Make no further adjustments to this objective.
3. Replace the 10X objective and remount the nosepiece.
4. Move the stage until the crosshair is centered on a feature.
5. Rotate the nosepiece to the next higher-power objective. Do not move the stage. Using the centering tools, move the objective so that the same feature is centered on the crosshair.
6. Repeat for all objectives in ascending order of magnification. Now, when the nosepiece is rotated, all objectives will center on the target.

Centering the Lamp

The transmitted-illumination lamp is permanently fixed in the optical system and need not be adjusted. For reflected light, follow these steps:

1. Rotate the nosepiece so that the lowest-power objective is in use.
2. Close the forward field diaphragm on the illuminator tube until the diaphragm is visible in the eyepiece. Then open the field diaphragm until it is just outside of the field of view.
3. Hold a piece of white paper under the objective.
4. Remove an eyepiece, and observe the image of the illuminator filament being reflected by the white paper. Verify that it is centered in the eyepiece hole. The angle of the filament is not important.

Centering the Lamp (continued)

5. There are two adjustments on the lamp housing. One is a thumb screw (lamp vertical centering ring) that allows rotating the filament up and down. The other (lamp lateral centering screw) moves the filament from right to left.
   a. Loosen the setscrew and rotate the lamp so that the filament is centered in the aperture, then tighten the thumbscrew.
   b. Adjust the black knob that moves the filament from right to left (lamp lateral centering screw). Center the filament in the aperture.
6. Replace the eyepiece.
7. Check, using the VLS-I's optical profile: With the 100X objective focused on a clear area, the profile will be flat. Separate the measuring gates to their widest positions and make them as tall as possible. Observe that, while moving the filament left to right, the flat profile moves up and down. When it is as high as possible, illumination is properly adjusted.

Transmitted Light Adjustment

1. Place a mask on the microscope stage and, using reflected light, focus on the edge of a chrome line. Use a mask with mostly a clear field. (The reason for using reflected light is that focus is often easier to find in reflected light.)
2. Switch to transmitted light.
3. Close the transmitted-light field diaphragm.
4. Using the substage condenser focus knob, bring the field diaphragm into focus. The edge of the line and the field diaphragm should now be in focus.
5. Center the field diaphragm, using the condenser-lens centering screws.
6. Open the field diaphragm to just outside the field of view.
7. Close the aperture diaphragm until it is 2/3 the numerical aperture of the objective being used. (The condenser is marked with numbers. Set at 0.65 when measuring with the 100X objective.)
8. Koehler illumination has now been achieved. Note that the field diaphragm and the specimen are in focus at the same time. Do not vary the substage controls once these conditions have been met.

Note: The substage condenser is now close to the backside of the mask, close enough to cause reflections if you switch to measuring in reflected light. When measuring in reflected light, back the substage down so these reflections do not occur.

ADJUSTMENTS

Microscope

Reflected Light Field Diaphragm Adjustment

The field diaphragm can be used as a focus aid to help quickly find focus. Close the diaphragm and operate the focus control to bring the edges of the diaphragm into focus. The specimen will also be in focus.

Centering the Aperture Diaphragm

CAUTION

ADJUSTMENTS IN THIS AREA SHOULD BE MADE ONLY BY OSI-TRAINED SERVICE PERSONNEL. THE SYSTEM MUST BE RECALIBRATED AFTER ANY ADJUSTMENT IN THIS AREA.

It is very important that the aperture diaphragm be maintained at the same adjustment for which the VLS-I was calibrated. The diaphragm is observed by removing an eyepiece and looking at the back of the microscope objective. To see the diaphragm clearly, first focus on a moderately smooth surface. (If the surface is too smooth, the diaphragm will be seen but no light will be seen in the remainder of the objective, and centering the diaphragm relative to the lens will be difficult to judge.) The reflected-light aperture diaphragm diameter is adjusted to 2/3 the diameter of the 100X objective and locked at the factory. This setting is performed using a light meter to assure repeatability.

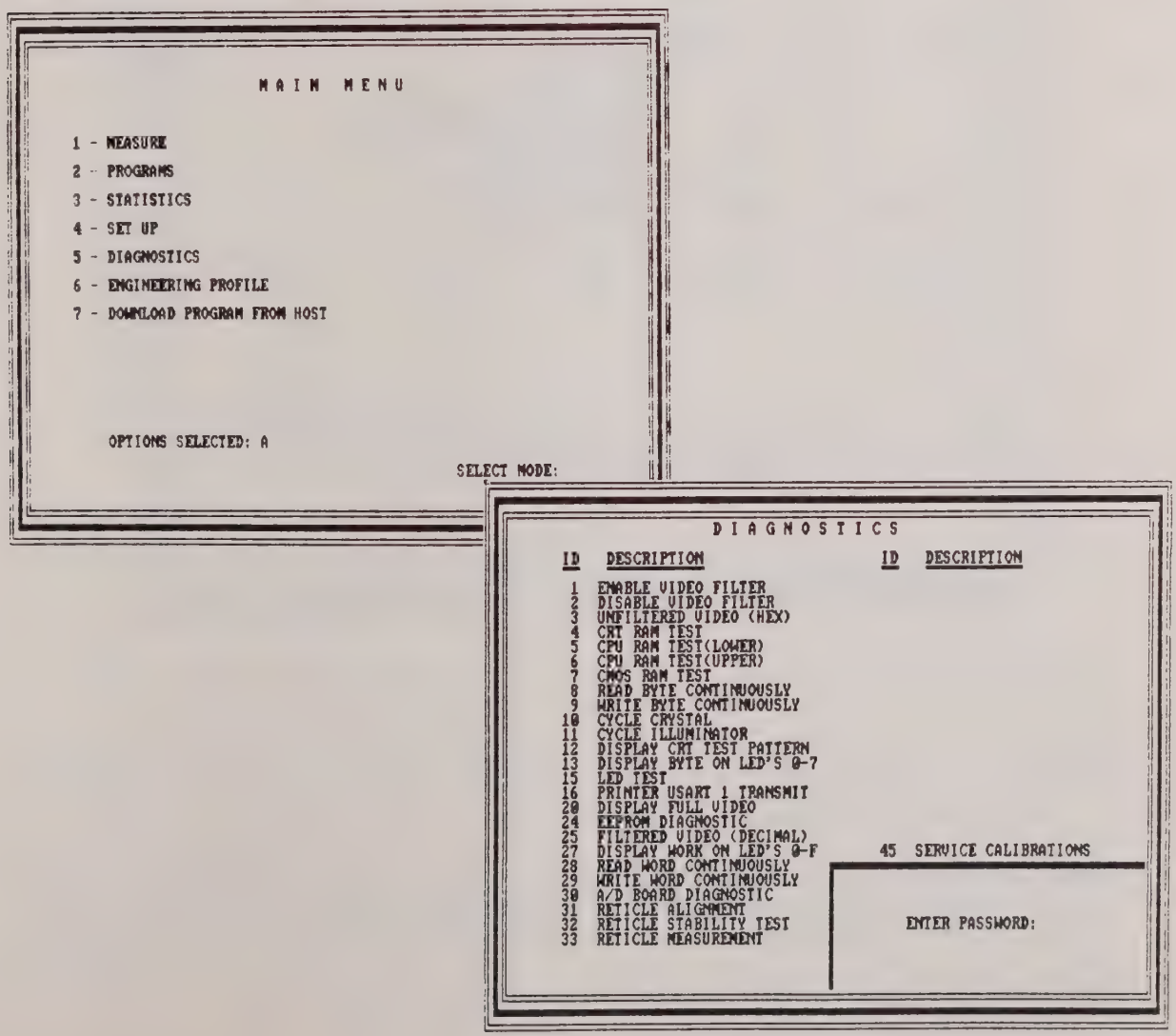
If it should require adjustment, the socket head capscrew located on the right side of the illuminator (adjacent to the A on the aperture diaphragm lever) can be loosened and the diaphragm readjusted. Centration can be altered slightly during handling and assembly of the microscope components. When checking centration of the aperture diaphragm, it is very important that the eye be positioned so that it is looking directly down the center of the eyepiece tube. If the diaphragm is slightly off center, check the attachment locks between the stand and the illuminator.

SERVICE CALIBRATION

These procedures describe how to calibrate the VLS-I. Complete system calibration must be performed whenever an objective or camera is replaced. Otherwise, calibrations may be checked every 4-6 months. Total time required to perform system calibration is 4-8 HOURS, depending on the extent of calibration needs and/or parts replaced.

Access to Calibrations

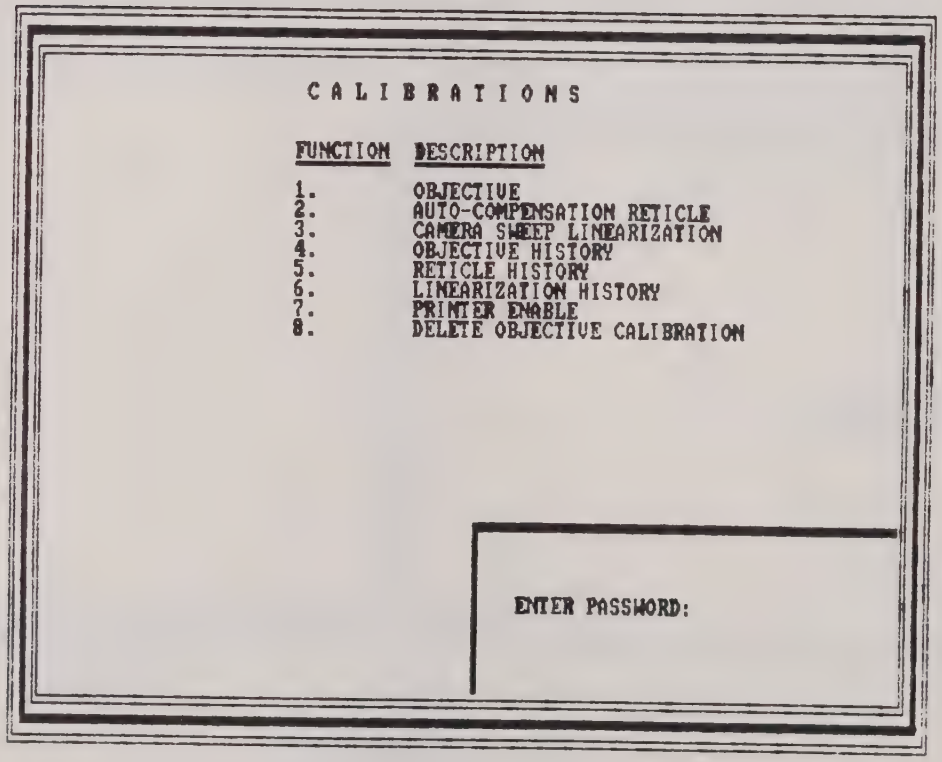
Enter the DIAGNOSTICS mode from the MAIN MENU (FUNCTION 5) and select Function 45 - SERVICE CALIBRATIONS. The calibrations menu appears, along with a request to enter a second-level password. To obtain the second-level password, OSI Field Service must be contacted. Please call (415) 490-6400 for more information concerning calibrations.



SERVICE CALIBRATION

Calibrations - What They Mean

The CALIBRATIONS menu looks like this.



FUNCTIONS 4, 5, and 6 show the results of calibrations performed in the first three choices--i.e., objective history shows the results of the most recently performed objective calibrations.

For familiarization, let's examine the three histories first.

SERVICE CALIBRATION

Calibrations - What They Mean

Function 4 - Objective History

OBJECTIVE CALIBRATION HISTORY

OBJ	100X	40X	20X	10X	5X
DATE	011485	011485	011485	011485	011485
EMP #	125	125	125	125	125
LT	35	35	35	35	35
RT	35	35	35	35	35
METHOD	1 - MAJOR	1 - MAJOR	1 - MAJOR	1 - MAJOR	1 - MAJOR
SLOPE	3- 1.06357	1.05960	1.06835	1.00740	1.01758
Y-INT	3- 0.023 uM	0.155 uM	0.089 uM	0.586 uM	-1.090 uM
	2- 1.06357				
	2- 0.023 uM				
	1- 1.06357				
	1- 0.023 uM				

This shows all the objectives calibrated into the system. Up to five objectives may be calibrated but the system is shipped calibrated for three -- 10X, 40X and 100X.

All systems are factory-calibrated in transmitted light at 35% thresholds against an NBS-traceable AR-chrome photomask.

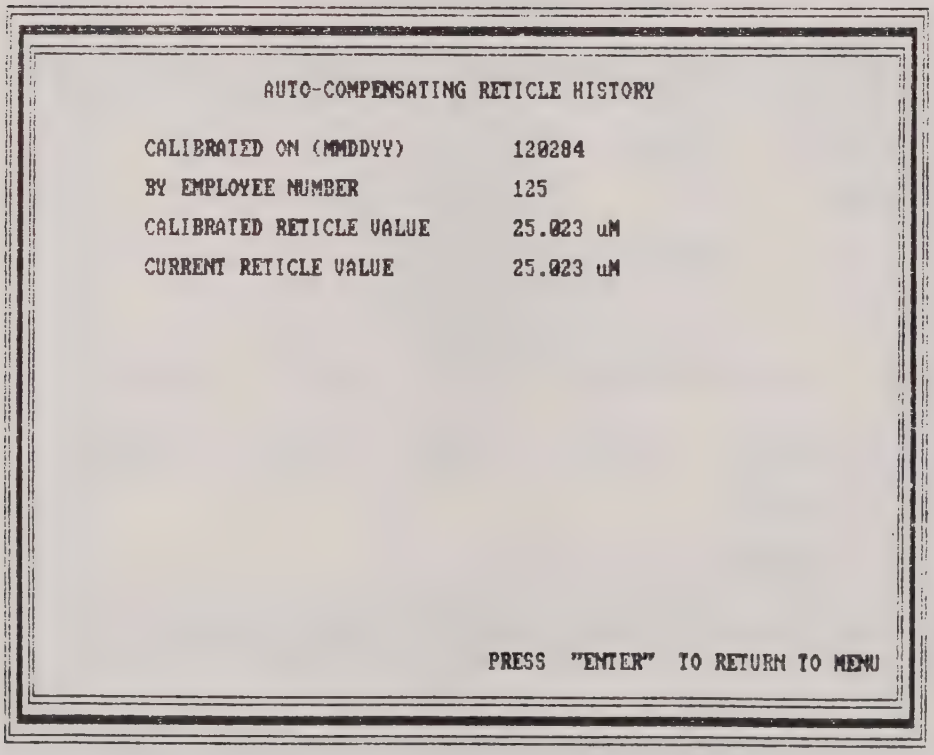
The slope and intercept information shown are the parameters of a linear regression on the data used in calibration. The linear regression technique is recommended by NBS and assures system-to-system measurement consistency.

The additional slope/intercept information for the 100X objective compensates for nonlinear optical transfer on masks in the vicinity of lum and smaller lines. For this additional information to be shown, a known submicron line (only one) must have been used in the actual 100X calibration.

SERVICE CALIBRATION

Calibrations - What They Mean

Function 5 - Reticle History

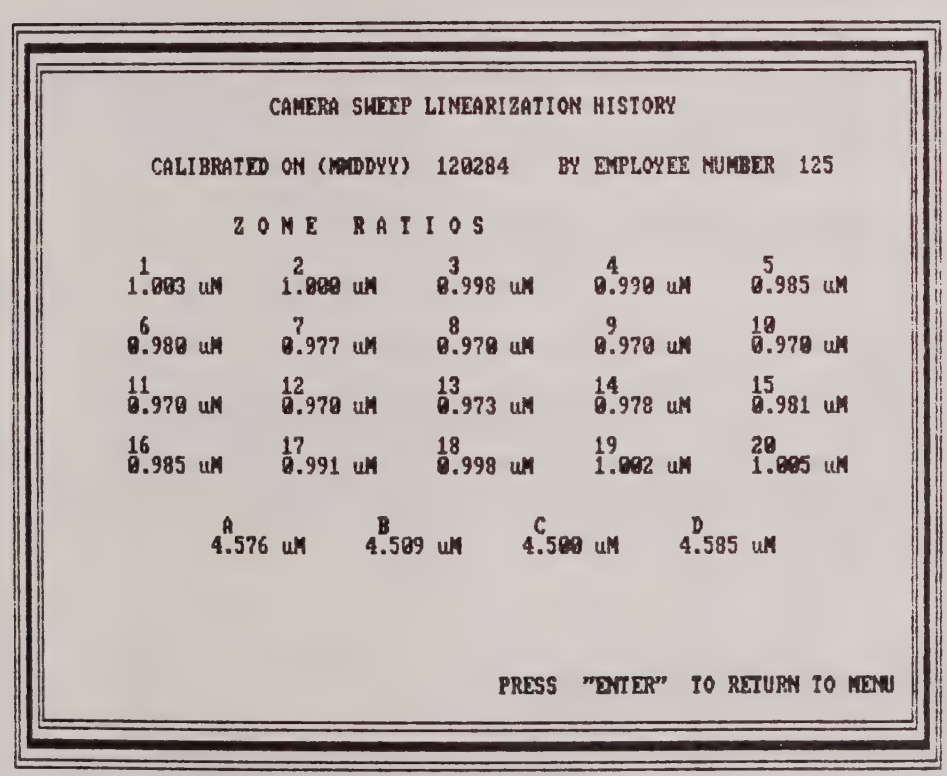

AUTO-COMPENSATING RETICLE HISTORY
CALIBRATED ON (MMDDYY) 120284
BY EMPLOYEE NUMBER 125
CALIBRATED RETICLE VALUE 25.023 uM
CURRENT RETICLE VALUE 25.023 uM
PRESS "ENTER" TO RETURN TO MENU

A reticle defining the measurement area, is located in the system's optical path very near the Newvicon tube. Periodically, the system measures the distance between the brackets on this reticle. Any measured changes can be detected and compensated out of the system.

The system is self-calibration in that no operator action is required to initiate the routine measuring of the brackets.

Reticle history shows, along with administrative data, the reticle width when the system was last calibrated and the width last measured in self-calibration.

Function 6 - Linearization History



CAMERA SWEEP LINEARIZATION HISTORY

CALIBRATED ON (MMDDYY) 120284 BY EMPLOYEE NUMBER 125

ZONE RATIOS

1 1.003 uM	2 1.000 uM	3 0.998 uM	4 0.990 uM	5 0.985 uM
6 0.980 uM	7 0.977 uM	8 0.970 uM	9 0.970 uM	10 0.970 uM
11 0.970 uM	12 0.970 uM	13 0.973 uM	14 0.978 uM	15 0.981 uM
16 0.985 uM	17 0.991 uM	18 0.998 uM	19 1.002 uM	20 1.005 uM

A 4.576 uM	B 4.509 uM	C 4.500 uM	D 4.585 uM

PRESS "ENTER" TO RETURN TO MENU

The allowable measurement area has been divided into 20 nominal lum segments. A submicron line was measured eight times in each segment. Any differences in measurements between segments are the result of variations in the camera's electron beam speed as it sweeps the measurement area. These variations are measured in the linearization calibration and are compensated for during linewidth measurements.

Linearization history shows the measurements obtained in each of the 20 small zones, plus measurements in four large zones used for overall control.

SERVICE CALIBRATION

Calibration Functions - How to Perform

Function 7 Printer Enable

Selecting FUNCTION 7 allows the printer to be disabled during calibration.

Function 8 - Delete Objective Calibration

Selecting this FUNCTION allows any objective calibrations to be removed. This would only be used if an objective was removed from the system and would not ever be used again. Removing that objective from the table prevents the operator from making a measurement using the wrong objective.

Function 9 - Transfer Calibration Table to EEPROM

> CAUTION
>
> FUNCTION 9 should only be performed by OSI Service Engineers, incorrect use of this function deletes all PROGRAM DATA, STATISTICS, and CALIBRATION.

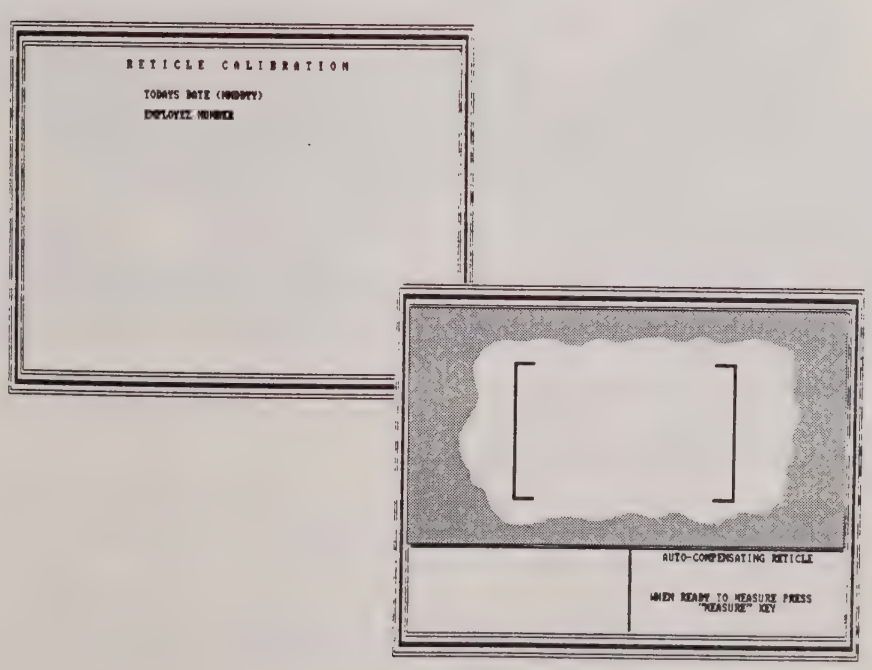
FUNCTION 9 enables the calibrations from the old CMOS to be moved into the EEPROM. This function is only available when new software is put into a system which had version 1 or version 2 software. This procedure can only be performed once.

SERVICE CALIBRATION

Calibrations - How to Perform

> **CAUTION**
>
> The system must be thoroughly warmed up and stable before calibration is attempted. Wait a minimum of 30 minutes, preferably an hour, before proceeding.
>
> Calibrations must be performed in the order shown since subsequent steps depend on earlier calibrations.
>
> A new set of calibrations is accepted only if the calibration sequence is performed in its entirety. Pressing the MAIN MENU key any time prior to completing a calibration will abort out of that calibration and leave prior values intact.

Function 2 - Auto-Compensation Reticle:



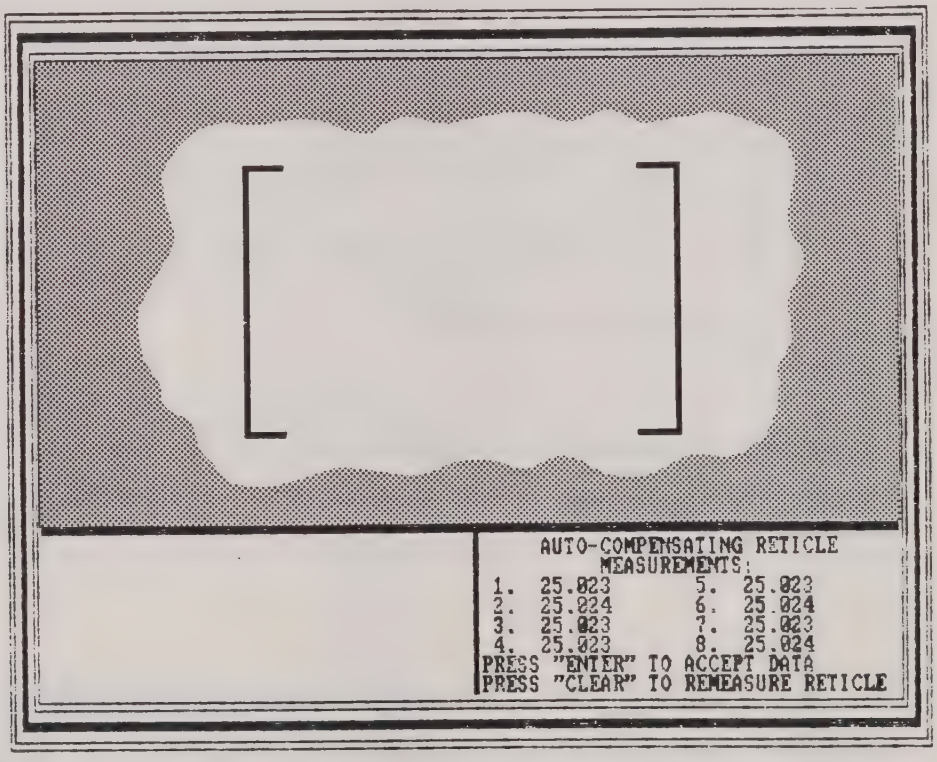
1. Enter date (mmddyy) and employee number of person calibrating.

2. Press the ENTER key. The screen will display live video and the message, WHEN READY TO MEASURE, PRESS MEASURE.

Calibrations - How to Perform

Function 2 - Auto-Compensation Reticle:

3. Place a reflective specimen on the stage. The specimen should have no strong features in the vicinity of the measurement brackets.



4. When the MEASURE key is pressed, the stage drops slightly out of focus and the system measures the distance between the brackets eight times in succession.

5. The measurement must be 25um +/- 1um. If the measurements exhibit greater than 0.010um variation, press the CLEAR key and the system will automatically remeasure eight times.

6. If the measurements exhibit no greater variation than 0.010um, press the ENTER key to accept the measurements. You will be returned to the calibration menu.

7. Press the RESET switch immediately.

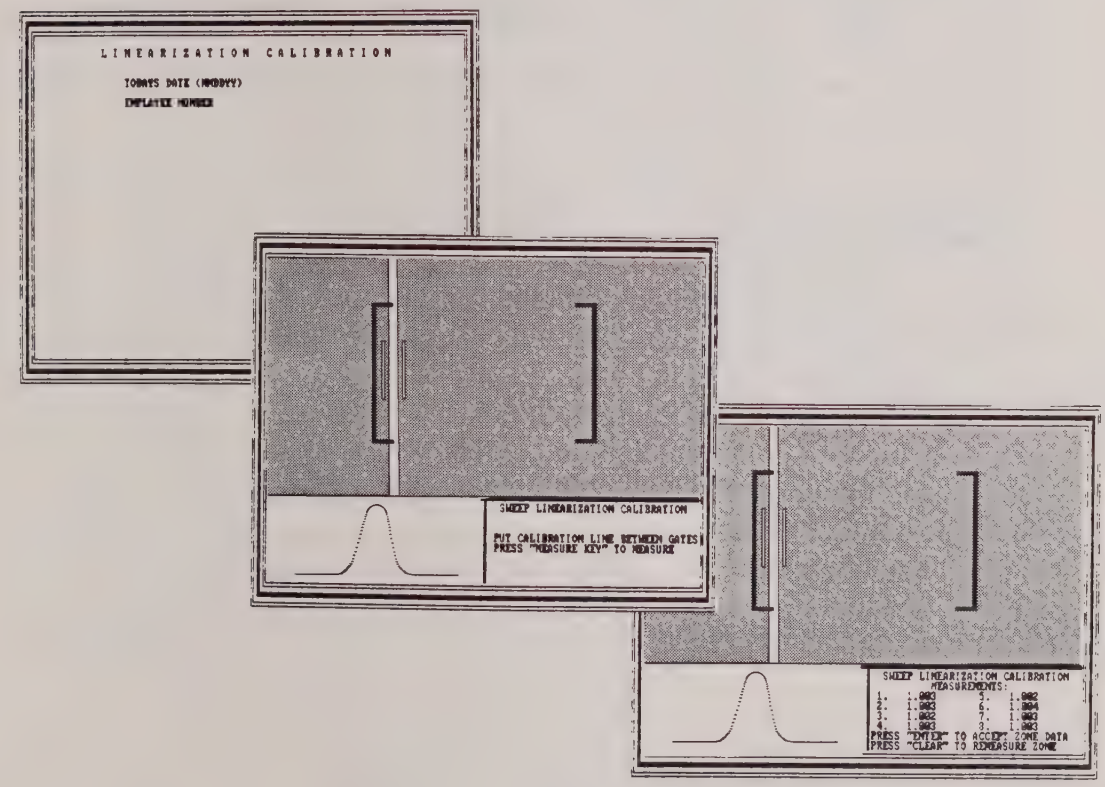
8. Return to the CALIBRATIONS mode. (MAIN MENU/mode 5-DIAGNOSTICS/45-SERVICE CALIBRATIONS.)

SERVICE CALIBRATION

Calibrations - How to Perform

Function 3 - Camera Sweep Linearization:

This procedure consists of measuring a nominal 0.75um line at 20 locations and a larger (nominal 4um) line at four locations. The measurement gates will automatically position themselves for each set of measurements, then upon pressing the MEASURE key, measure the line eight times. The average of these eight measurements constitutes the linewidth used for linearization compensation in each segment.



1. Enter date (mmddyy) and employee number of person calibrating.

2. Press the ENTER key. The screen will display live video with the measurement gates positioned at the left of the measurement area.

3. Position the small line (0.75um or less) between the gates. Be sure the profile is symmetrical, assuring the small line is positioned completely within the gates.

4. Press the MEASURE key. The line will be measured automatically eight times.

Calibrations - How to Perform

Function 3 - Camera Sweep Linearization:

5. If measurements vary more than 0.020um, press the CLEAR key and the system will automatically repeat the measurements.

6. If the variation is less than 0.020um, press the ENTER key. The set of measurements will be accepted and the gates automatically positioned at the next measurement segment.

7. This procedure is repeated at 20 locations across the measurement area.

8. Where the last small line has been measured, the gates will reposition at the left of the measurement area but this time will have greater separation.

9. Place the nominal 4um line between the gates and repeat the above sequence four times across the measurement area.

10. When the entire sequence is completed, press the ENTER key to accept all of the above, or press the CLEAR key to remeasure the 4um line. Linearization calibration is complete and you will be returned to the calibrations menu.

SERVICE CALIBRATION

Calibrations - How to Perform

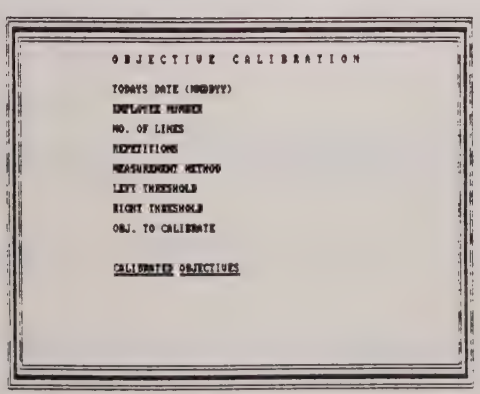
Function 1 - Objective Calibration

> CAUTION
>
> Objective calibration involves a linear regression of X-Y pairs consisting of standard and measured values. If any of the values are incorrect, the routine will still fit to the erroneous values and yield an improper calibration. Be especially careful when calibrating objectives into the system.
>
> Also note: at least three standard values are required for linear regression.
>
> Good calibration practice dictates that each line be measured in sequence to avoid systematic errors arising from positioning, focusing, etc. Measure the first standard, then the second, etc., then return to the first standard for the second repetition, etc.

Before entering FUNCTION 1, center the transmitted light aperture diaphragm and adjust its diameter to 0.65 scale reading using a light meter. Check that the lamp is centered and adjust if necessary. Adjust the field diaphragm so that it is just visible in the edge of the eyepiece field.

Calibrate the objectives in transmitted light using an NBS standard, or an OSI submaster created from an NBS standard.

Enter FUNCTION 1 and the following screen will be presented: (Entries shown are examples.)



SERVICE CALIBRATION

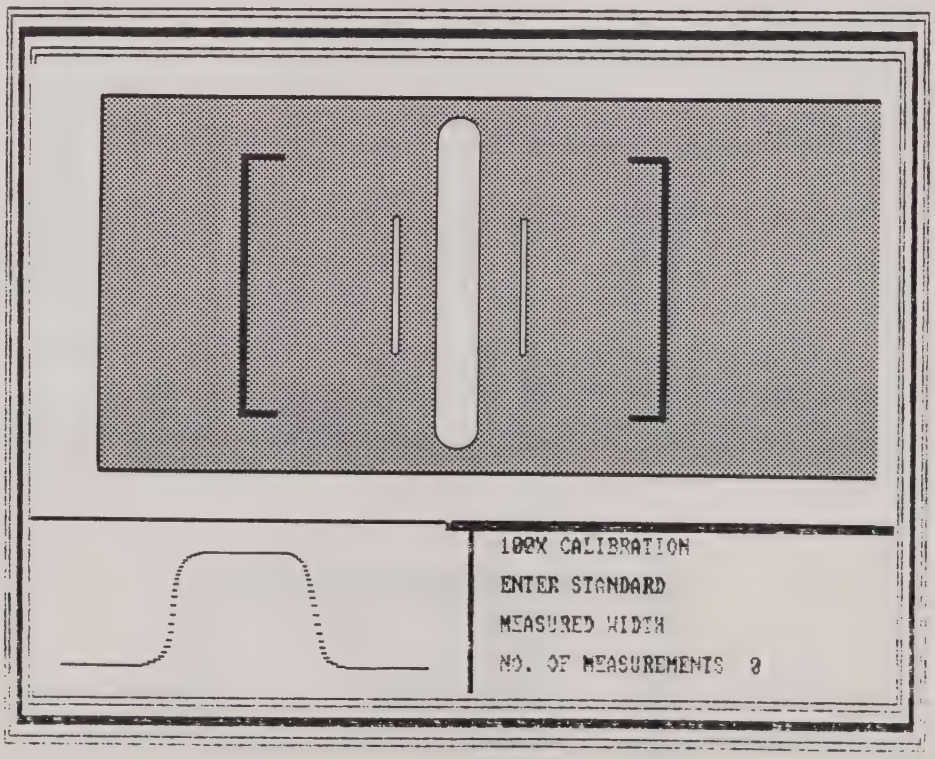
Calibrations - How to Perform

Function 1 - Objective Calibration

The system is calibrated in transmitted light, using method 1 (for masks) and with 35% thresholds. Measure the clear lines on an opaque background. Any objective can be calibrated.

Note: When a complete system calibration is being performed refer to the Certificate of Calibration that is shipped with each system for a review of the entire objective calibration procedure.

1. After entering the above data, press the ENTER key. The screen will display live video, and in the lower right box:



2. Type the known linewidth after ENTER STANDARD, then press the ENTER key.

3. The cursor will blink at MEASURED WIDTH. Press the MEASURE key. When the measurement is obtained, it will display after MEASURED WIDTH.

Calibrations - How to Perform

Function 1 - Objective Calibration

4. If you made a mistake (measured the wrong line or entered the wrong standard), clear the measurement by pressing the CLEAR key. The standard and the measurement will disappear. The standard may be re-entered, then remeasured, to obtain a correct pair of calibration values.

5. Press the ENTER key to accept the measurement. Both fields will blank, awaiting a new entry for standard and a new measurement.
6. Repeat this procedure for each of the standards and for the number of repetitions indicated.

7. Each time a measurement and its standard value are accepted, "NO. OF MEASUREMENTS" increments one count. When "NO. OF MEASUREMENTS" reaches the product (NO. OF LINES X REPETITIONS), the objective calibration is completed.

8. One last screen asks you to press the ENTER key to accept the calibrations just performed. Pressing ENTER will wipe out previous calibrations for the objective being calibrated and store the new ones. This is the last chance to abort out of OBJECTIVE calibration (by pressing the MAIN MENU key) and to retain the earlier calibrations. Be confident the new calibration is what you want.

System calibrations are now complete. They can be checked by examining their history counterparts.

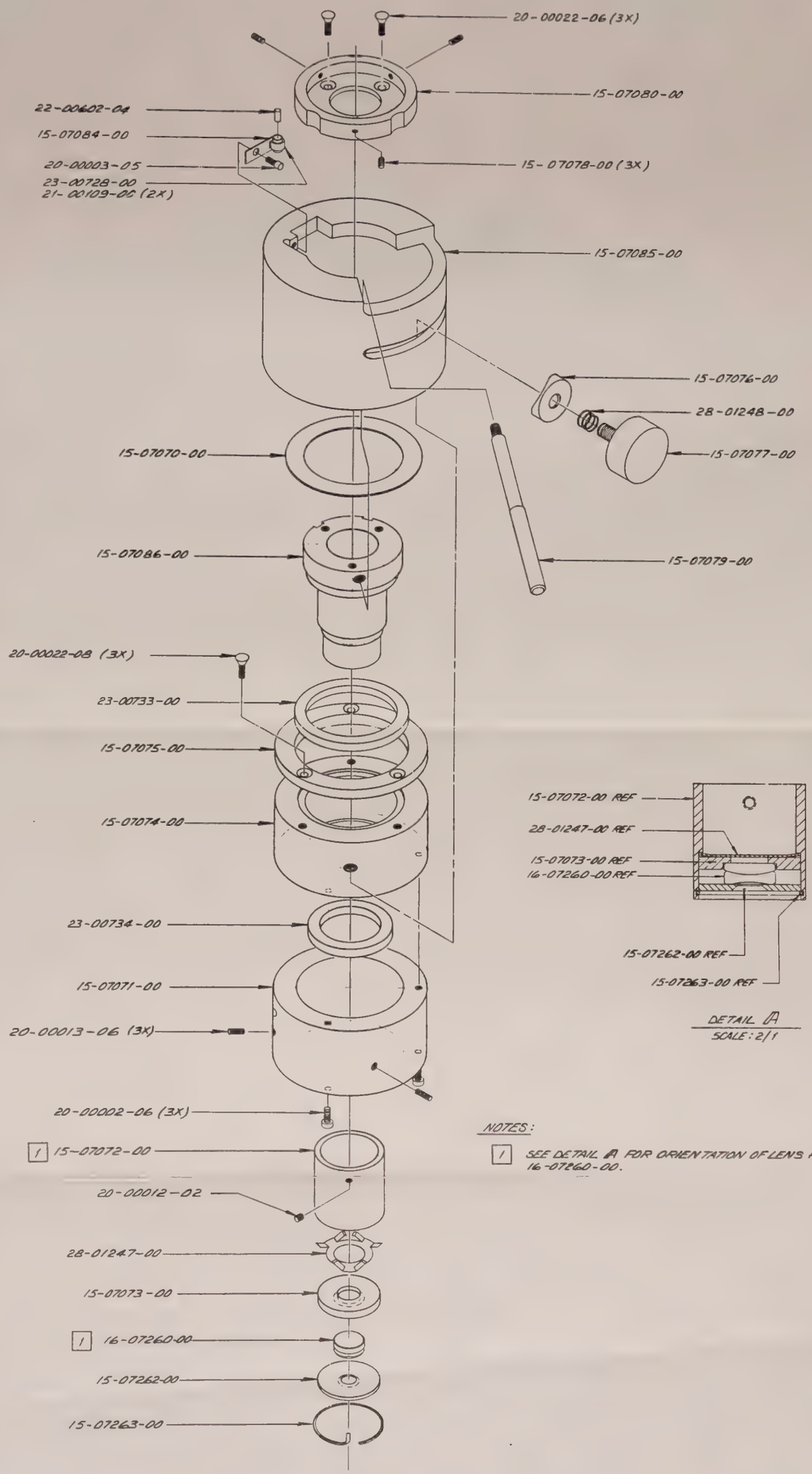
SPARE PARTS

Spares Kit-Level 2 (PN 14-07607-00-X4)

Part Number	Description	Quantity
01-07089-00	Keyboard Assembly	1
03-06875-00	A/D PCB Assembly	1
03-06879-00	CRT Control PCB Assembly	1
03-06942-00	VLS-I Interface PCB Assembly	1
03-07415-00	Buzzer PCB Assembly	1
03-07455-00	CPU PCB Assembly	1
03-07689-00	I/O PCB Assembly	1
03-09640-00	PCB Assembly, Illuminator	1

SCHEMATICS

DRAWING NUMBER	DRAWING TITLE
01-07081-00	Rotator, Image-VLS-I
01-07082-00	Card Cage Assembly, VLS-I
01-07087-00	Microfocus Assembly
01-07088-00	CRT Assembly
01-07089-00	Keyboard Assembly
01-07782-00	Transformer Assembly
01-07911-00	Reticle Mount Assembly
01-07932-00	Microscope Assembly (Nikon Stage)
01-08571-00	Electrical Chassis Assembly
01-08579-00	Microscope Assembly 50W
01-08691-00	Camera Assembly
01-09744-00	Camera Cover Assembly
01-09745-00	Camera Cover Mount
03-07455-00	CPU PCB Assembly
07-06864-00	Schematic, Connector PCB
07-06873-00	Schematic, A/D PCB
07-06877-00	Schematic, CRT Control Board
07-06939-00	Schematic, VLS-I Interface PCB
07-07416-00	Schematic, Buzzer PCB
07-07575-00	Mother PCB Schematic
07-07692-00	I/O PCB, Schematic
07-07795-00	Schematic, COHU Camera
07-07912-00	Multi Volt Transformer Schematic
07-08534-00	Electric, Chassis Interconnect
07-09641-00	Schematic, Illuminator Board



DETAIL A
SCALE: 2/1

NOTES:

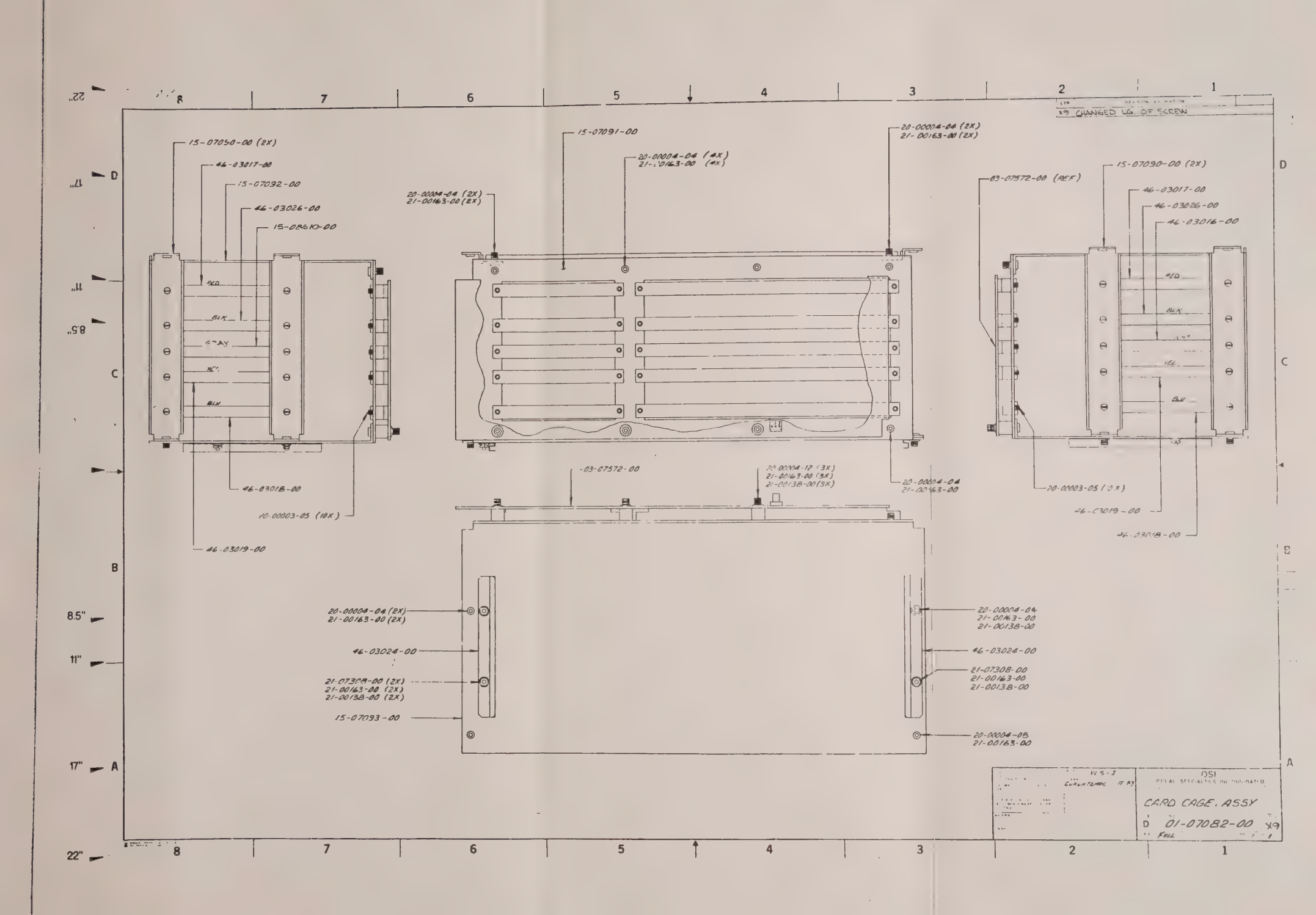
/1 SEE DETAIL A FOR ORIENTATION OF LENS P/N 16-07260-00.

VCS-I (2-83)

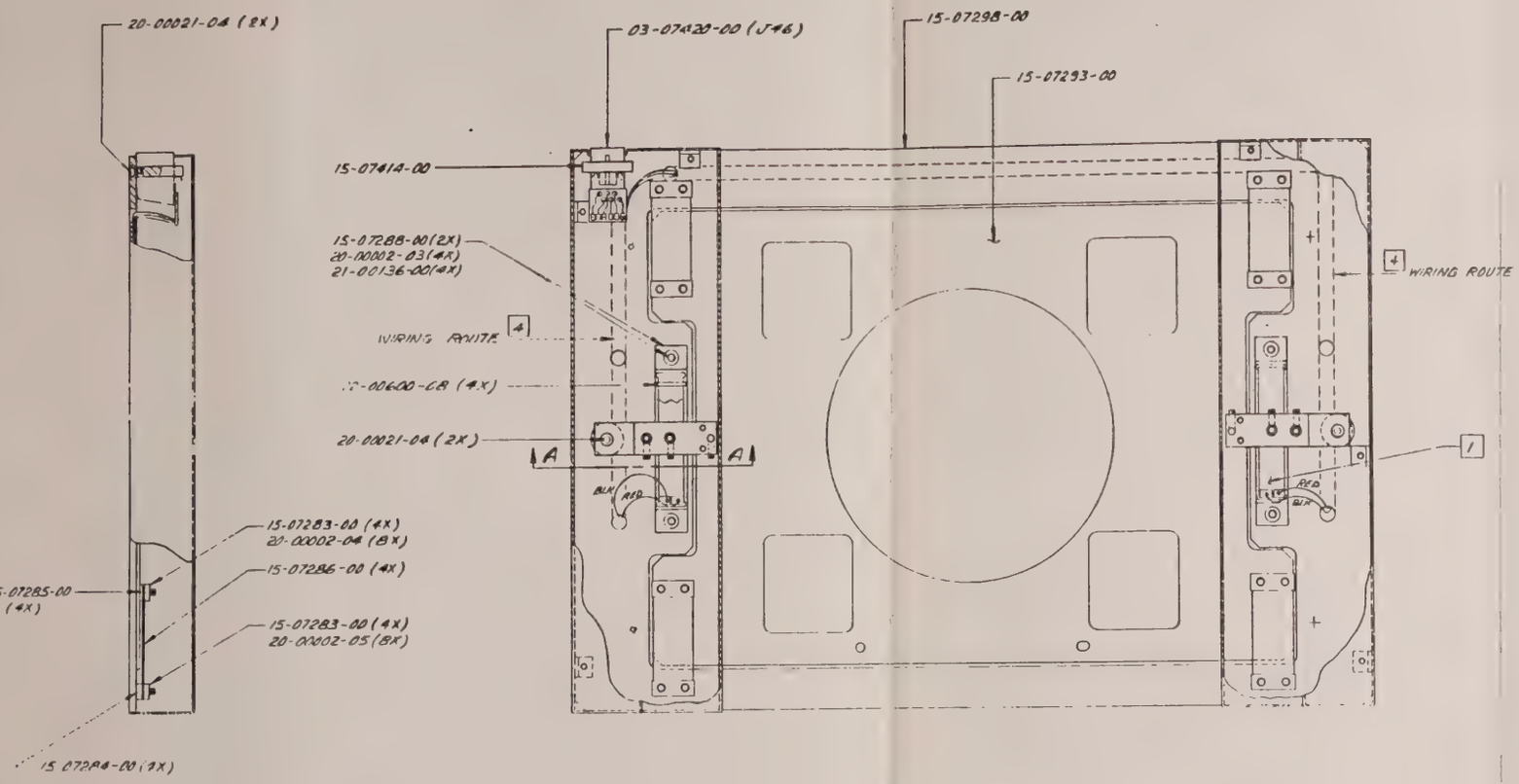
OSI

ROTATOR IMAGE VCS-I

D 01-07081-00 X8

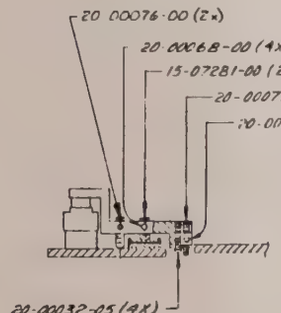

LTR
X9 CHANGED LG. OF SCREEN
15-07050-00 (2X)
46-03017-00
15-07092-00
46-03026-00
15-08610-00
RED
BLK
GRAY
WHT
BLU
46-03018-00
20-00003-05 (10X)
46-03019-00
15-07091-00
20-00004-04 (4X)
21-00163-00 (4X)
20-00004-04 (2X)
21-00163-00 (2X)
20-00004-04 (2X)
21-00163-00 (2X)
03-07572-00 (REF)
15-07090-00 (2X)
46-03017-00
46-03026-00
46-03016-00
RED
BLK
GRAY
WHT
BLU
20-00003-05 (10X)
46-03019-00
46-03018-00
03-07572-00
20-00004-12 (3X)
21-00163-00 (3X)
21-00138-00 (3X)
20-00004-04
21-00163-00
20-00004-04 (2X)
21-00163-00 (2X)
46-03024-00
21-07308-00 (2X)
21-00163-00 (2X)
21-00138-00 (2X)
15-07093-00
20-00004-04
21-00163-00
21-00138-00
46-03024-00
21-07308-00
21-00163-00
21-00138-00
20-00004-08
21-00163-00
V.S.I.
OSI
CARD CAGE, ASSY
D 01-07082-00 X9
FULL

LTR	REVISION DESCRIPTION	
X9	ADDED 20-00076-00 2x & 2 MORE 20-00068-00	DG10-1-84

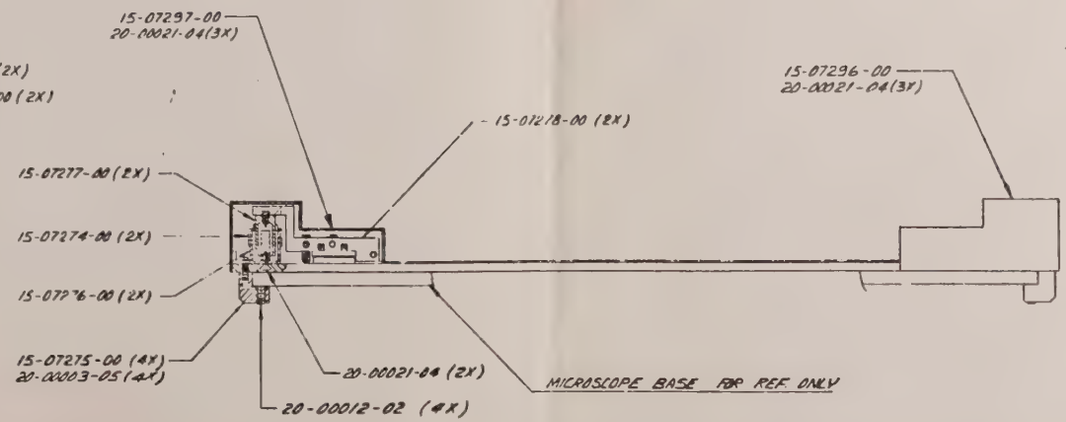


NOTES:

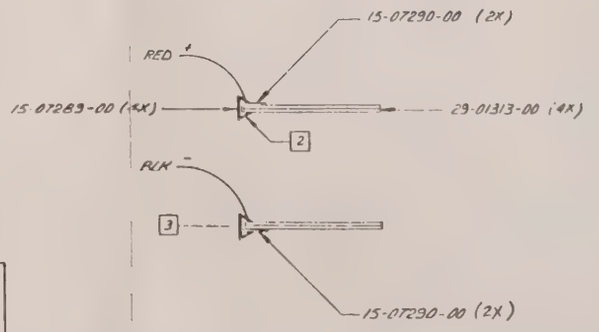
1. FOR CRYSTAL - INSULATOR INSTALLATION SEE DETAIL B.
2. CRYSTAL CLIP ON RED WIRE MAKES CONTACT WITH BOTTOM CRYSTAL AND IS INSULATED FROM TOP CRYSTAL.
3. CRYSTAL CLIP ON BLACK WIRE MAKES CONTACT WITH TOP CRYSTAL AND IS INSULATED FROM BOTTOM CRYSTAL.
4. AFTER WIRING INSTALLATION, COVER THE SLOT WITH RTV BLACK SILICONE P/N 50-03400-00



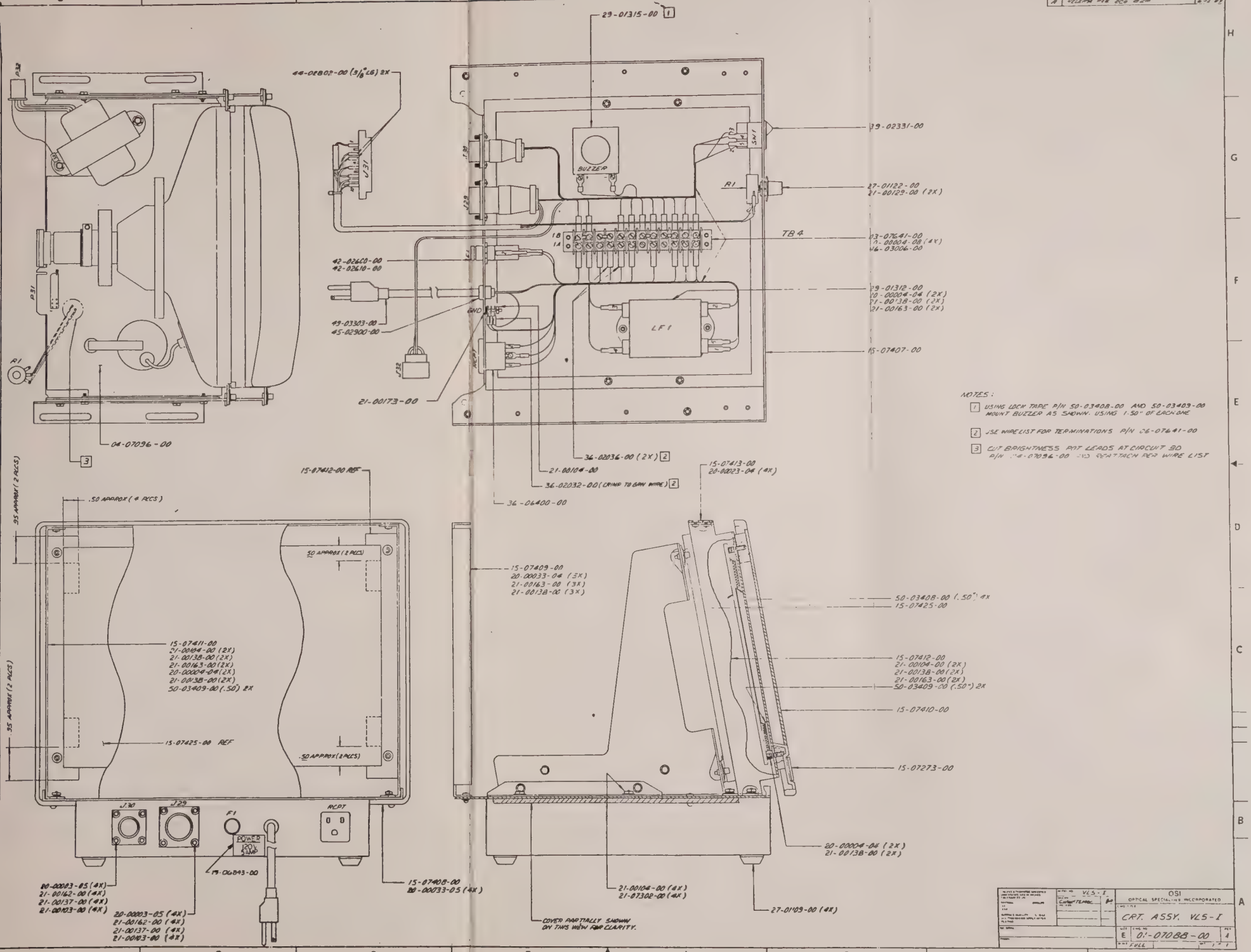
SECTION A-A
SCALE 1:1



DETAIL B
NOT TO SCALE



MODEL NO. VLS-I	OSI OPTICAL SPECIALTIES INCORPORATED	
DRAWN CHARLOTTESVILLE, VA 9-83	D.G. TITLE MICROFOCUS ASSY. VLS-I	
MATERIAL SEE L/M	SIZE D	DWG NO. 01-07087-00 REV X9
	SCALE 1:1	SHT 1 OF 1



NOTES:

1. USING LOCK TAPE P/N 50-03408-00 AND 50-03409-00 MOUNT BUZZER AS SHOWN. USING 1.50" OF EACH ONE
2. USE WIRE LIST FOR TERMINATIONS. P/N 06-07641-00
3. CUT BRIGHTNESS POT LEADS AT CIRCUIT 30 P/N 04-07096-00 SEE ATTACH PER WIRE LIST

LTR	DESCRIPTION	DATE
A	RELEASE PER ECO 824	4-1-82

OSI
OPTICAL SPECIALTIES INCORPORATED

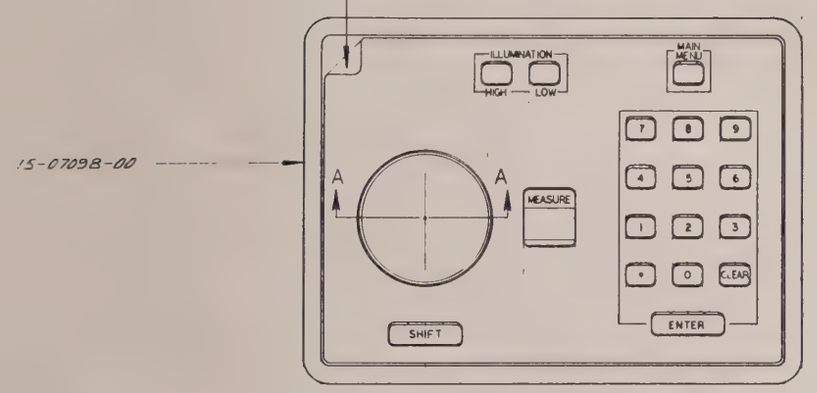
CRT. ASSY. VLS-I

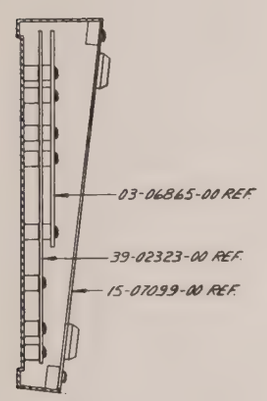
SIZE E | DWG NO 01-07088-00 | REV A

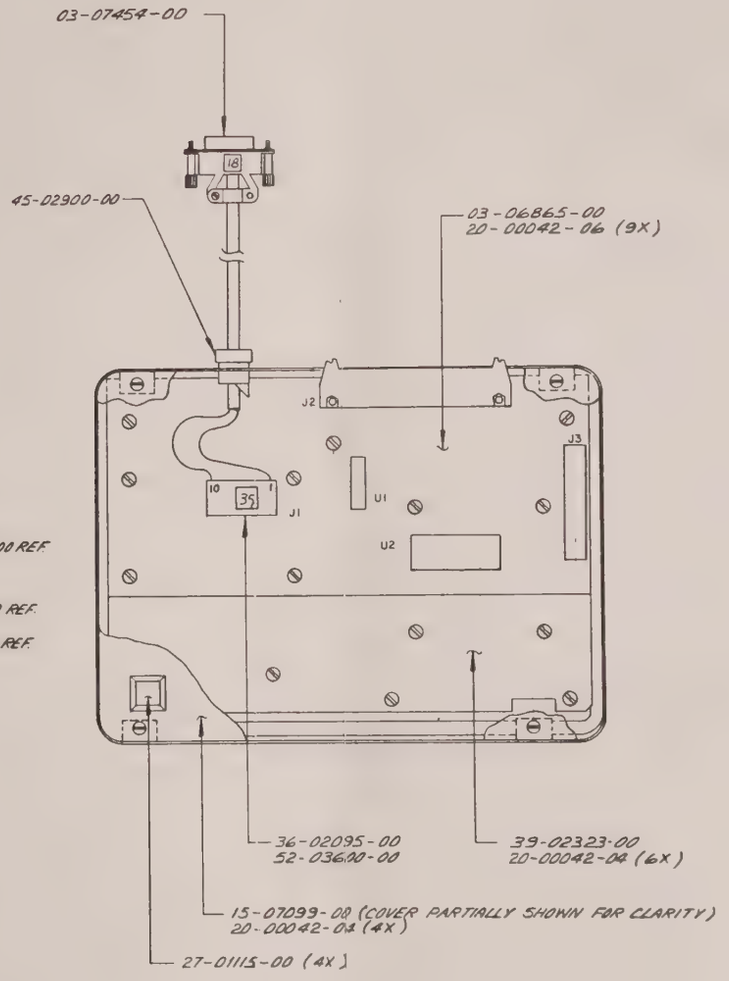
SCALE FULL | WT | SHT 1 OF 1

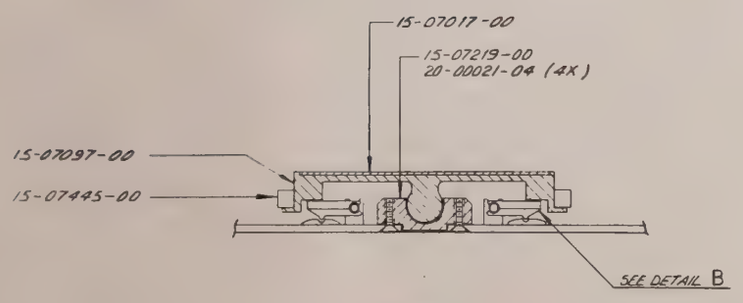
NOTES:

1. CUT BUTTONS AS SHOWN ON DETAIL 'B' FOR FITTING PURPOSES.

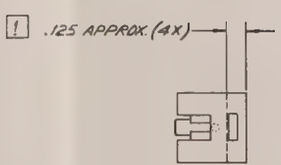








SECTION A-A
SCALE 1:2



DETAIL B
SCALE 1:2

DRAWN	VLS-I	11-83
CHECKED		
MATERIAL		

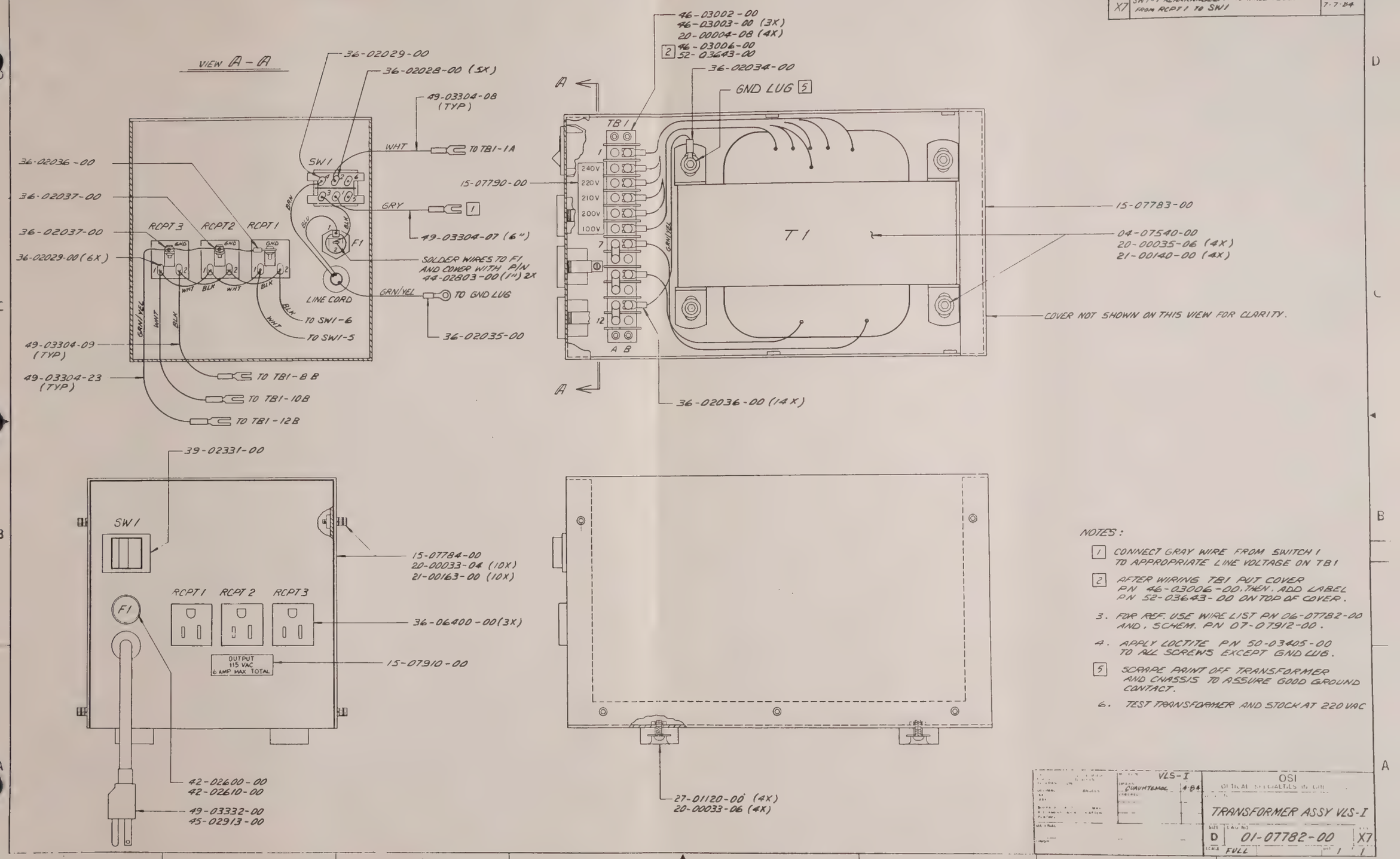
OSI
OPTICAL SPECIALTIES INCORPORATED

DWG TITLE
KEYBOARD ASSY. VLS-I

SIZE	DWG NO	REV
D	01-07089-00	X8

SCALE FULL SHT 1 1

REVISIONS			
LTR	DESCRIPTION	BY	DATE
X7	SW1-1 REARRANGED. TWO WIRES ADDED FROM RCPT 1 TO SW1		7-7-84

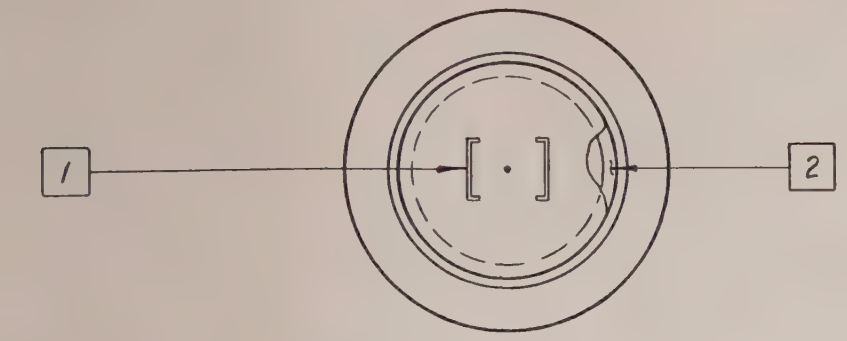


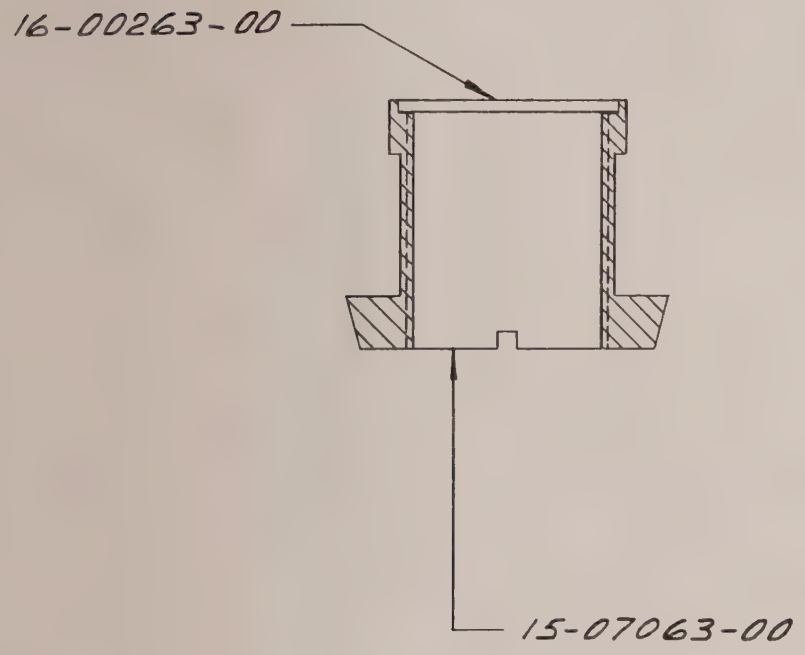
NOTES:

1. CONNECT GRAY WIRE FROM SWITCH 1 TO APPROPRIATE LINE VOLTAGE ON TB1
2. AFTER WIRING TB1 PUT COVER P/N 46-03006-00, THEN ADD LABEL P/N 52-03643-00 ON TOP OF COVER.
3. FOR REF. USE WIRE LIST P/N 06-07782-00 AND, SCHEM. P/N 07-07912-00.
4. APPLY LOCTITE P/N 50-03405-00 TO ALL SCREWS EXCEPT GND LUG.
5. SCRAPE PAINT OFF TRANSFORMER AND CHASSIS TO ASSURE GOOD GROUND CONTACT.
6. TEST TRANSFORMER AND STOCK AT 220 VAC

	VLS-I	4-84	OSI
			TRANSFORMER ASSY VLS-I
			SIZE D DWG NO 01-07782-00 REV X7
			SCALE FULL SHT 1 OF 1

LTR	REVISION DESCRIPTION



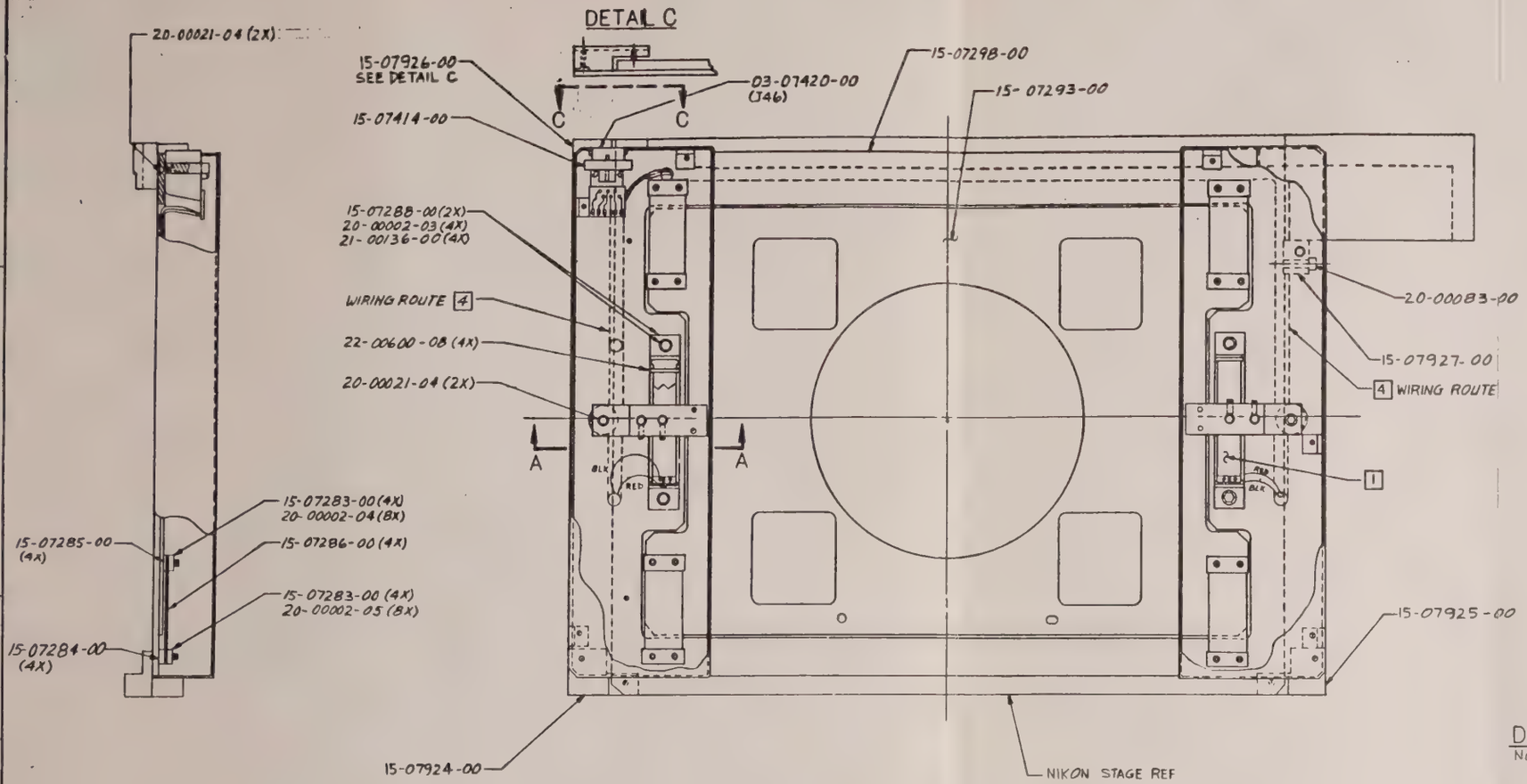


NOTES:

1. PRINTED LINES ON PN 16-00263-00 TO FACE NEAR SIDE.
2. APPLY PN 50-03402-00 3 PLCS, EVENLY SPACED ON PN 15-07063-00.

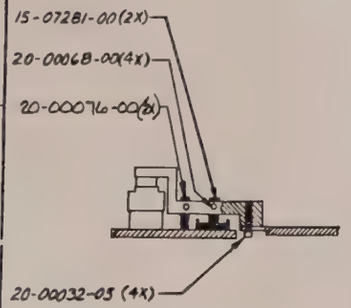
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMAL XX ±.01 XXX ±.005 SURFACE QUALITY 63 MAX ALL DIMENSIONS AFTER FINISH PLATING	MODEL NO VLS-I	OSI OPTICAL SPECIALTIES INCORPORATED
	DRAWN CVAUNTEMDC 5-84	DWG TITLE RETICLE MOUNT ASSY.
MATERIAL	CHECKED	SIZE B DWG NO 01-07911-00 REV X1
		SCALE 2/1 SHEET 1 OF 1

LTR	REVISION DESCRIPTION		
X1	PROTOTYPE		6/5/84
X2	REVISED SECTION A-A	JL	1-22-85

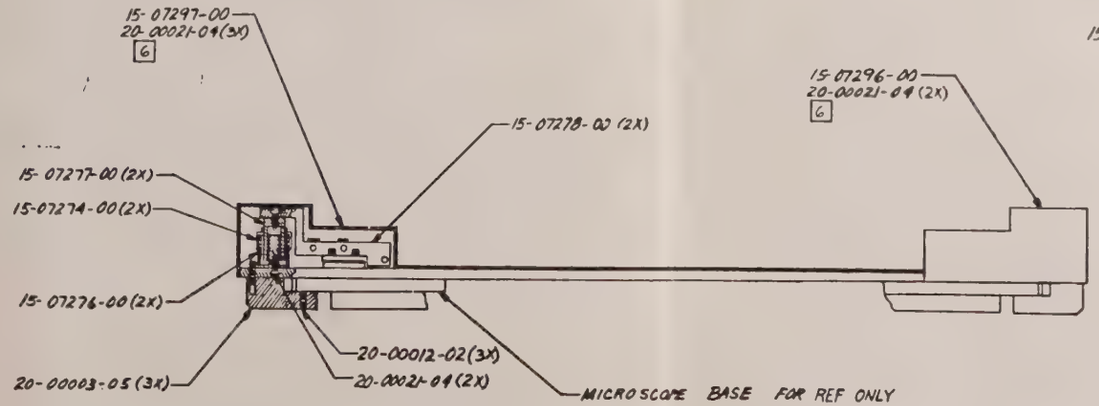


NOTES:

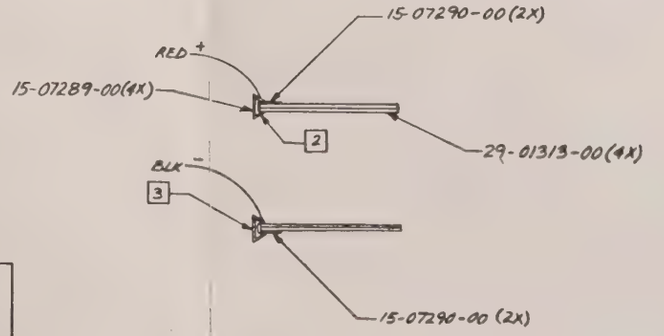
1. FOR CRYSTAL - INSULATOR INSTALLATION SEE DETAIL B
2. CRYSTAL CLIP ON RED WIRE MAKES CONTACT WITH BOTTOM CRYSTAL, AND IS INSULATED FROM TOP CRYSTAL
3. CRYSTAL CLIP ON BLACK WIRE MAKES CONTACT WITH TOP CRYSTAL, AND IS INSULATED FROM BOTTOM CRYSTAL
4. AFTER WIRING INSTALLATION, COVER THE SLOT WITH RTV BLACK SILICONE P/N 50-03400-00
5. FILL P/N 15-07276-00 (DAMPENING TUBE) APPROX. 2/3 FULL WITH P/N
6. ASSEMBLE STAGE COVERS AFTER MICROFOCUS PRE-LOAD ADJUST



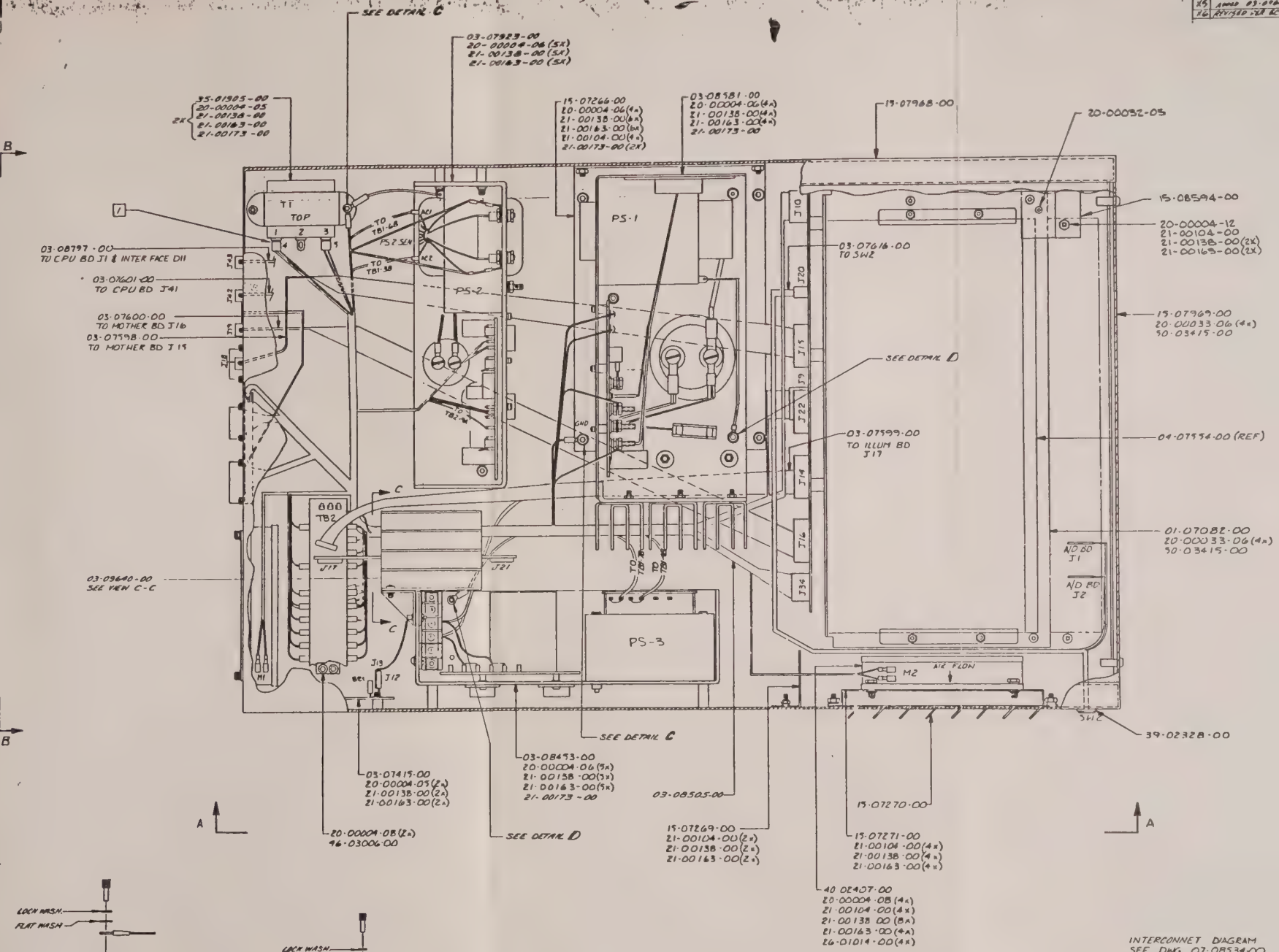
SECTION A-A

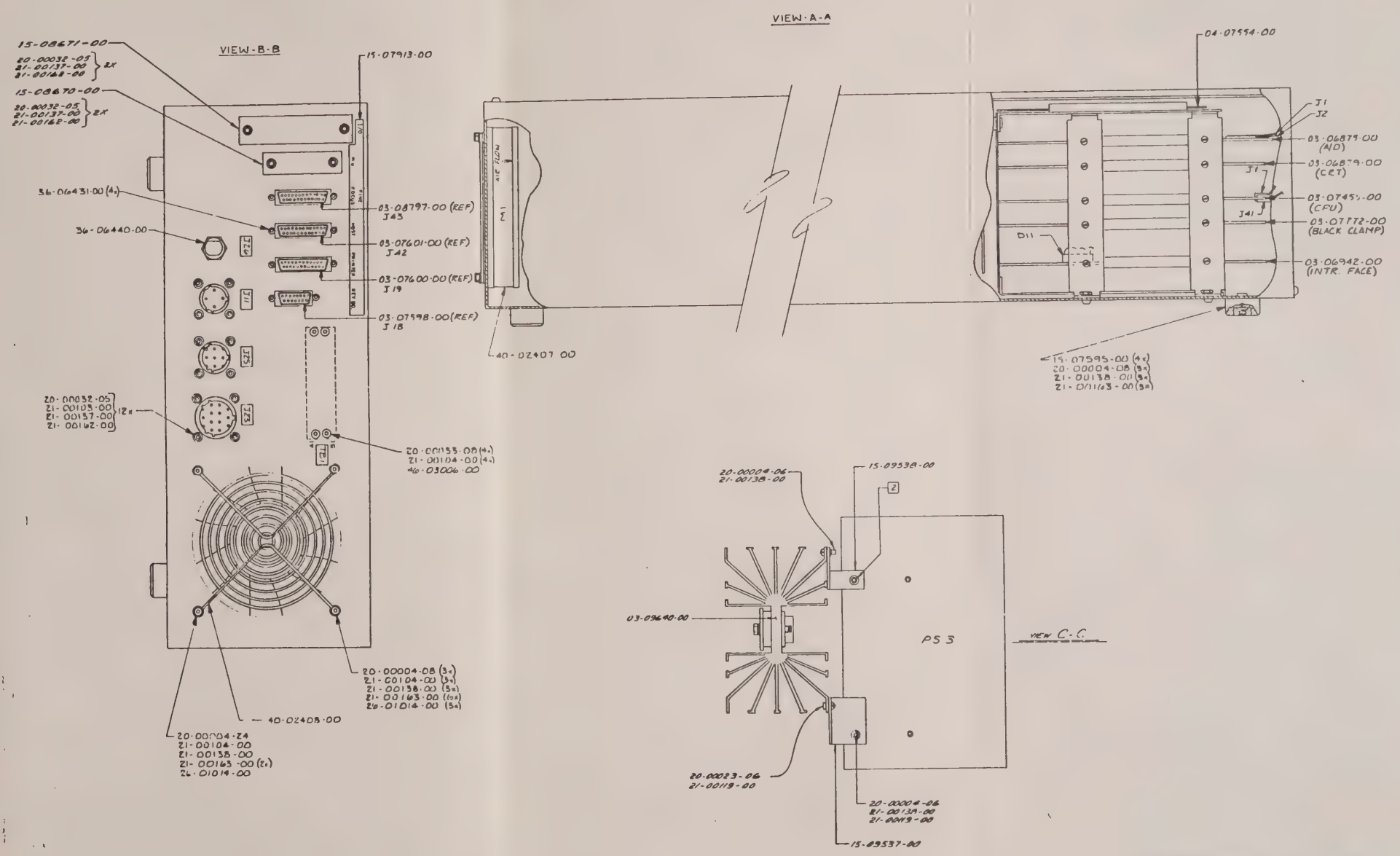


DETAIL B
NOT TO SCALE

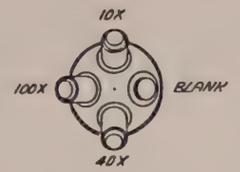


UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DECIMAL ANGLES SURFACE QUALITY FILL DIMENSIONS APPLY AFTER PLATING	VLS I SUZANNE	OSI OPTICAL SPECIALTIES INCORPORATED	
MATERIAL SEE B/M FINISH		DWG TITLE MICROFOCUS ASSY VLS I (NIKON STAGE)	
		SIZE D DWG NO 01-07932-00	REV X2
		SCALE 1:1	SHT 1 OF 1

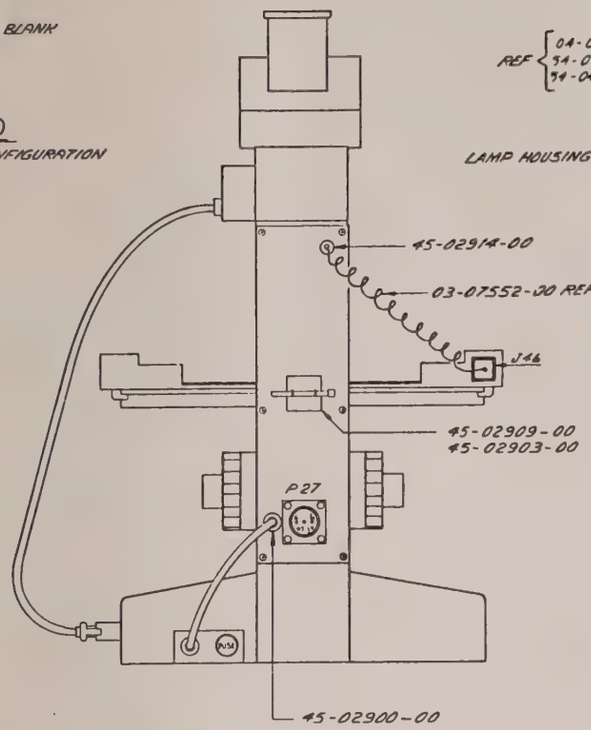

SEE DETAIL C
03-07923-00
20-00004-06 (5X)
21-00138-00 (5X)
21-00163-00 (5X)
35-01905-00
20-00004-05
21-00138-00
21-00163-00
21-00173-00
2X
15-07266-00
20-00004-06(4X)
21-00138-00(4X)
21-00163-00(4X)
21-00104-00(4X)
21-00173-00(2X)
03-08581-00
20-00004-06(4X)
21-00138-00(4X)
21-00163-00(4X)
21-00173-00
15-07968-00
20-00032-05
15-08594-00
20-00004-12
21-00104-00
21-00138-00(2X)
21-00163-00(2X)
03-07616-00
TO SW2
15-07969-00
20-00033-06(4X)
90-03415-00
SEE DETAIL D
03-07599-00
TO ILLUM BD J17
04-07994-00 (REF)
01-07082-00
20-00033-06(4X)
90-03415-00
39-02328-00
03-08797-00
TO CPU BD J1 & INTER FACE DII
03-07601-00
TO CPU BD J41
03-07600-00
TO MOTHER BD J16
03-07598-00
TO MOTHER BD J 15
03-08640-00
SEE VIEW C-C
03-07415-00
20-00004-05(2X)
21-00138-00(2X)
21-00163-00(2X)
20-00004-08(2X)
96-03006-00
03-08453-00
20-00004-06(5X)
21-00138-00(5X)
21-00163-00(5X)
21-00173-00
SEE DETAIL C
SEE DETAIL D
03-08505-00
15-07269-00
21-00104-00(2X)
21-00138-00(2X)
21-00163-00(2X)
15-07270-00
15-07271-00
21-00104-00(4X)
21-00138-00(4X)
21-00163-00(4X)
40 02407-00
20-00004-08(4X)
21-00104-00(4X)
21-00138 00(8X)
21-00163-00(4X)
26-01014-00(4X)
INTERCONNET DIAGRAM
SEE DWG 07-08534-00
TOP
TB1
TB2
PS-1
PS-2
PS-3
M1
M2
AIR FLOW
J10
J20
J15
J19
J22
J14
J16
J34
J17
J21
J13
J12
J18
J1
J2
N/D BD J1
N/D BD J2
SW2
LOCK WASH
FLAT WASH
STAR WASH
DETAIL C
2 PLCS
DETAIL D
2 PLCS
NOTES:
1 TIN TABS 1,2,3,4,5.
2 USE EXISTING FASTENERS
OSI
OPTICAL SPECIALTIES INCORPORATED
ELECTRONIC CHASSIS ASS'Y
01-08571-00

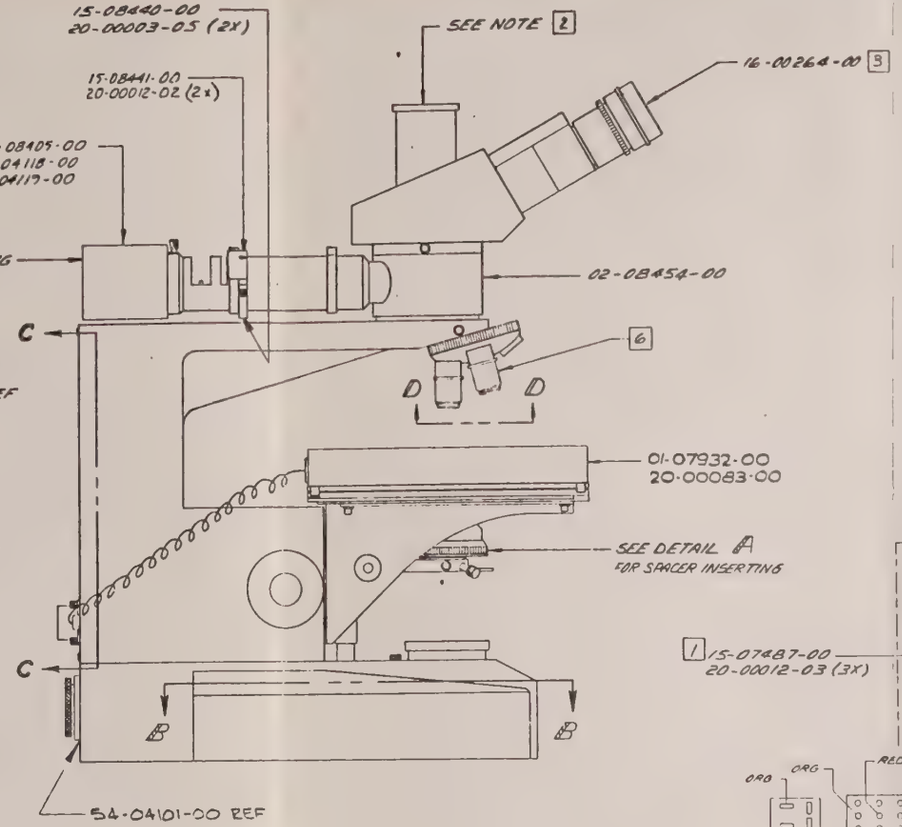

VIEW-B-B
VIEW-A-A
VIEW C-C
15-08671-00
20-00032-05
21-00137-00
21-00162-00
2X
15-08670-00
20-00032-05
21-00137-00
21-00162-00
2X
15-07913-00
36-06431-00 (4x)
36-06440-00
03-08797-00 (REF)
J43
03-07601-00 (REF)
J42
03-07600-00 (REF)
J19
03-07598-00 (REF)
J18
20-00032-05
21-00103-00
21-00137-00
21-00162-00
12x
20-00033-08 (4x)
21-00104-00 (4x)
46-03006-00
20-00004-08 (3x)
21-00104-00 (3x)
21-00138-00 (3x)
21-00163-00 (10x)
26-01014-00 (3x)
40-02408-00
20-00004-24
21-00104-00
21-00138-00
21-00163-00 (2x)
26-01014-00
40-02407-00
04-07554-00
J1
J2
J7
J41
03-06879-00
(A/D)
03-06879-00
(CRT)
03-07455-00
(CPU)
03-07772-00
(BLACK CLAMP)
03-06942-00
(INTR. FACE)
D11
15-07595-00 (4x)
20-00004-08 (3x)
21-00138-00 (3x)
21-00163-00 (3x)
20-00004-06
21-00138-00
15-09538-00
03-09640-00
PS 3
20-00023-06
21-00119-00
20-00004-06
21-00138-00
21-00119-00
15-09537-00
OSI
OPTICAL SPECIALTIES INCORPORATED
ELECTRONIC CHASSIS ASSY
01-08971-00
X6

LTR	REVISION DESCRIPTION	
X2	ADDED 15-08440-00 20-00013-04 15-08441-00 20-00012-02	10-12-84
X3	ADDED NOTE 8, P/N 31-08011-00, AND P/N 20-00018-03 W43, 20-00012-04	11-6-84
X4	DEL. 12-08579-00, ADD 01-07932-00/20-00083-00	12-84
X4.1	ADDED 50-04101-00 REF	12/6/84 JL
X5	REV DWG PER ECO 822 TI HO	6-7-85

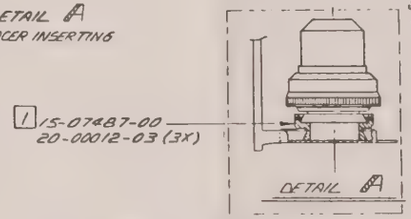


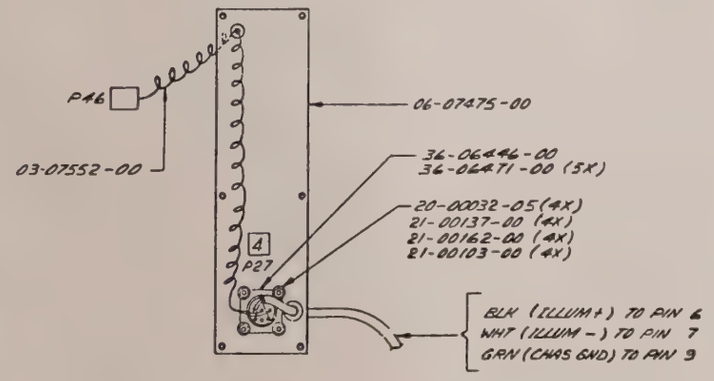
VIEW D-D
OBJECTIVE CONFIGURATION



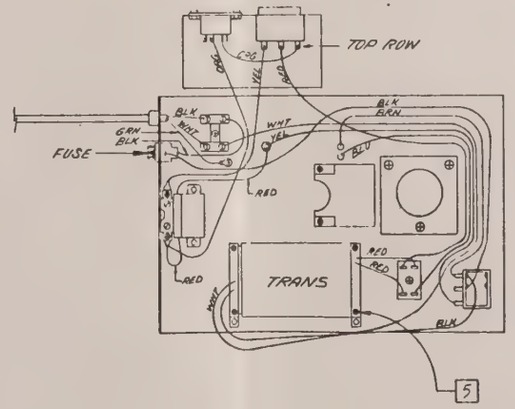


1. SPACER: LENS P/N 15-07487-00 TO BE ADDED AS SHOWN ON DETAIL A.
2. MODIFY TRINOCULAR TUBE PER OSI P/N 06-07602-00.
3. CROSSHAIR RETICLE P/N 16-00264-00 TO BE PLACED IN RIGHT EYEPIECE.
4. INSTALL LABELED PINS INTO CONNECTOR P27.
5. USE EXISTING SCREW TO ATTACH RESISTOR.
6. ATTACH AN ID LABEL (15-08756-00) TO EACH OBJECTIVE AFTER IT HAS BEEN CALIBRATED. SERIAL NO. SHOULD MATCH VLS-I ELECTRONIC CHASSIS
7. CUT OFF ALL TOP AND BOTTOM LEADS
8. SPLICE YELLOW TO ORANGE WIRE

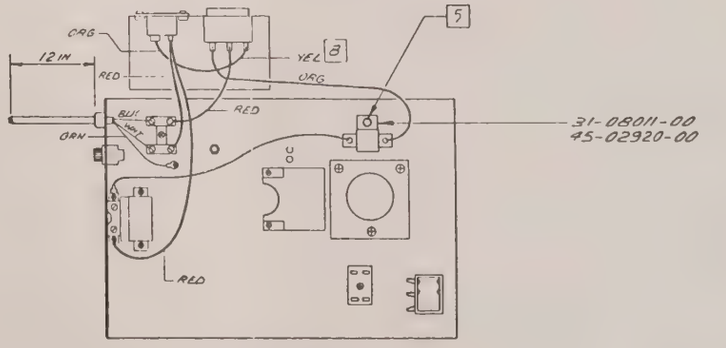




SECTION C-C

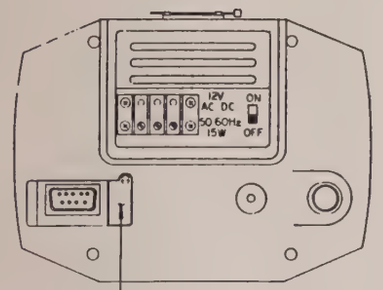


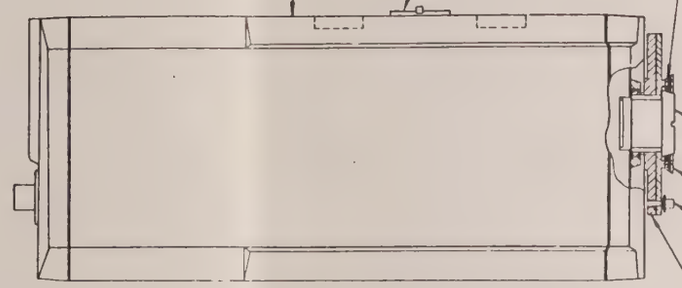
SECTION B-B
BEFORE

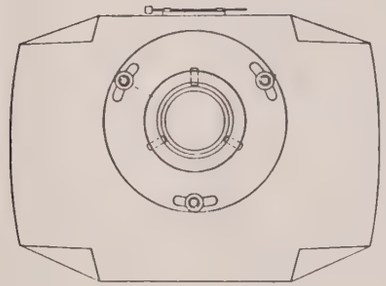


SECTION B-B
AFTER

MODEL NO	VLS-I	
DRAWN	CURRENTMOC	11-83
CHK'D		
OSI OPTICAL SPECIALTIES INCORPORATED		
DWG TITLE	MICROSCOPE ASSY. 50 W	
SIZE	D	
DWG NO	01-08579-00	X5
SCALE	HALF	







04-08666-00-A

45-02906-00
45-02903-00

15-07066-00 (3X)

15-06962-00

15-07065-00

01-07911-00
15-07062-00 (REF)

15-07064-00
20-00003-04 (3X)
21-00137-00 (3X)
21-00162-00 (3X)

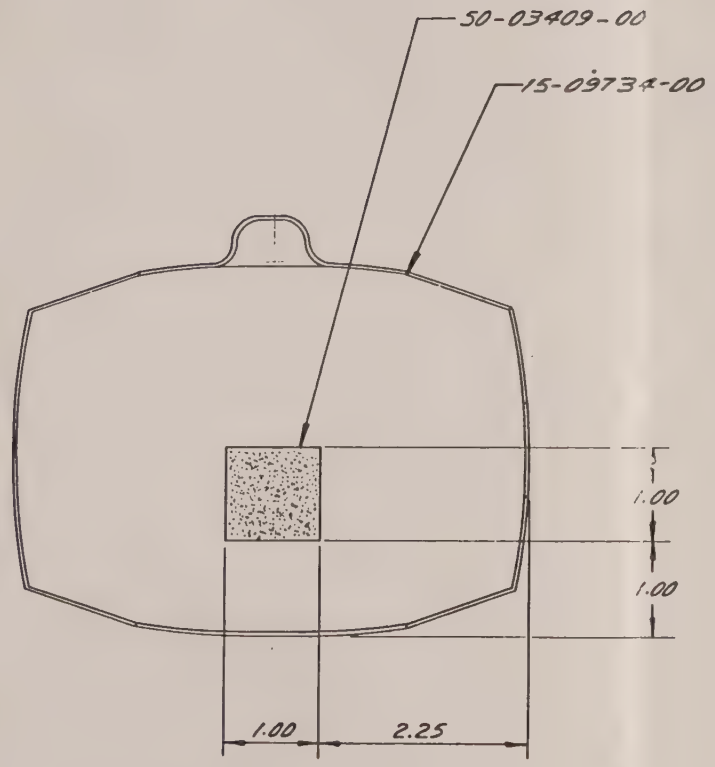
NOTES:

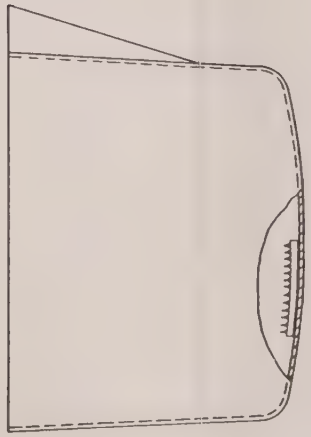
1. FOR REFERENCE, SEE SCHEM. DWG. P/N 07-07795-00.

LTR	REVISION DESCRIPTION

VLS-I	OSI OPTICAL SPECIALTIES INCORPORATED	
J. LEIS 12-20	CAMERA ASSY.	
	SIZE D | A3 NO 01-08691-00	REV X1

LTR	REVISION DESCRIPTION	
A	RELEASED PER ECO#900	12-85 J.K.





UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: DECIMAL .XX ± .XXX ± ANGLES ± SURFACE QUALITY: √ MAX ALL DIMENSIONS APPLY AFTER PLATING	MODEL NO	VLS-I, MV-PLUS	
	DRAWN	TEMO	12685
	CHECKED		
MATERIAL:			
FINISH:			

OSI
OPTICAL SPECIALTIES INCORPORATED

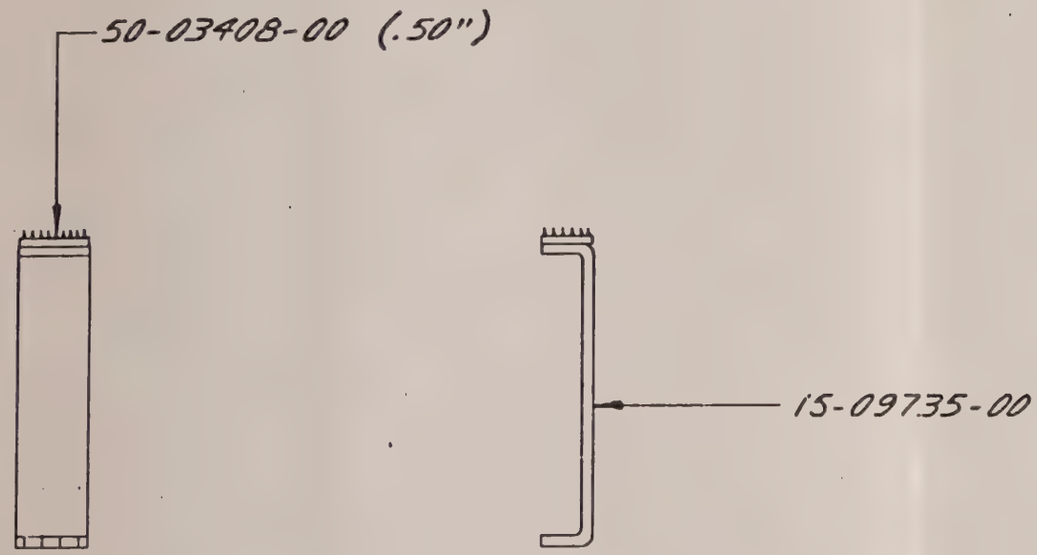
DWG. TITLE: CAMERA COVER ASSY.

SIZE	DWG. NO.	REV
C	01-09744-00	A

SCALE FULL SHT 1 OF 1

BISHOP GRAPHICS/ACCUPRESS
PO ORDER NO. 61037B

LTR	REVISION DESCRIPTION	
A	RELEASED PER ECO #900	12-85 DK



UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON
DECIMAL .XX ± .XXX ±
ANGLES ±
SURFACE QUALITY: √ MAX
ALL DIMENSIONS APPLY AFTER PLATING

MODEL NO. VLS-I, MV-PLUS

DRAWN	TEMO	12-9-85
CHECKED		

MATERIAL:

FINISH:

OSI
OPTICAL SPECIALTIES INCORPORATED

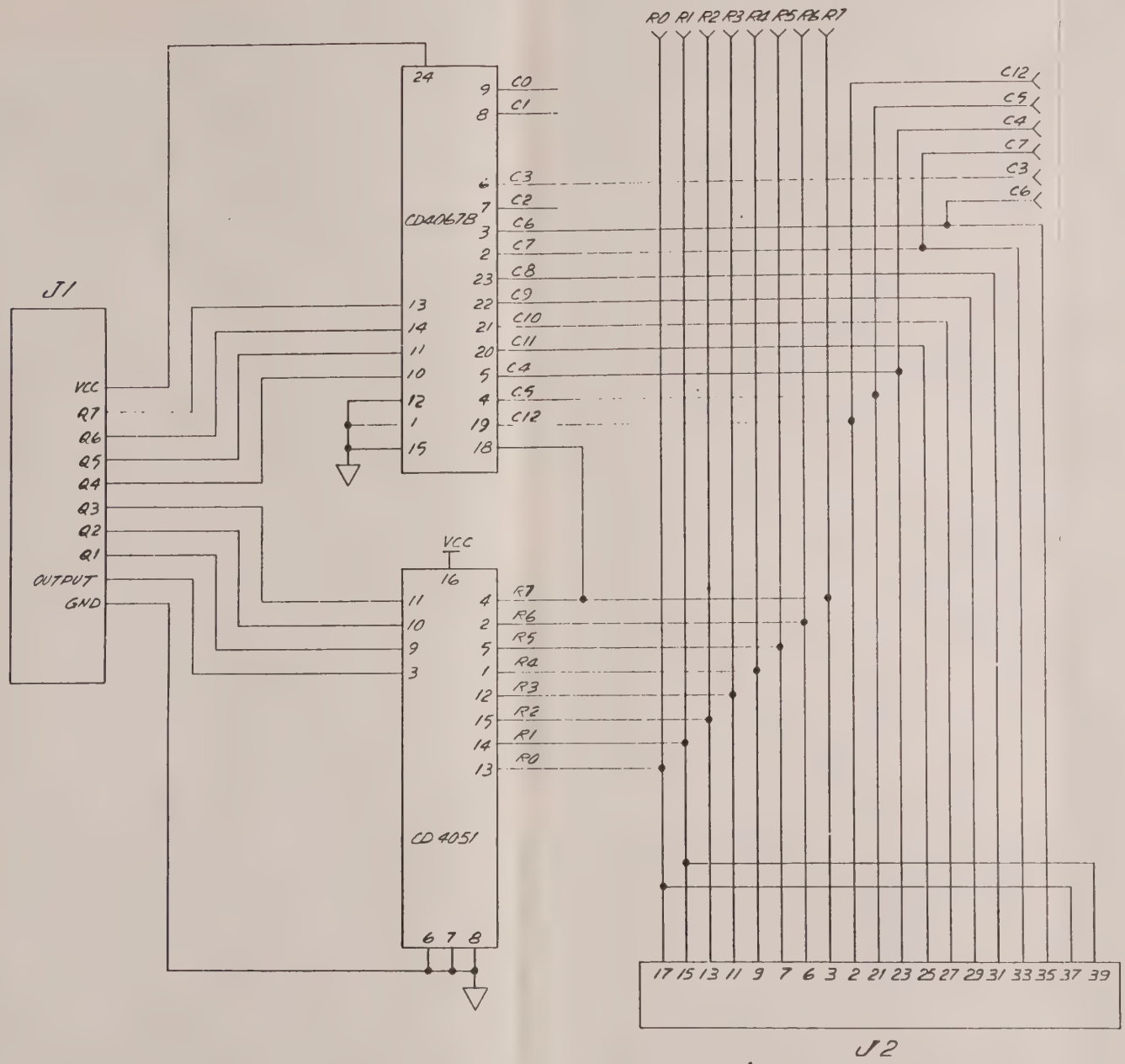
DWG. TITLE: CAMERA COVER MOUNT. ASSY

SIZE	DWG. NO.	REV
B	01-09745-00	A

SCALE FULL SHT 1 OF 1

BISHOP GRAPHICS/ACCUPRESS
REORDER NO. A10378

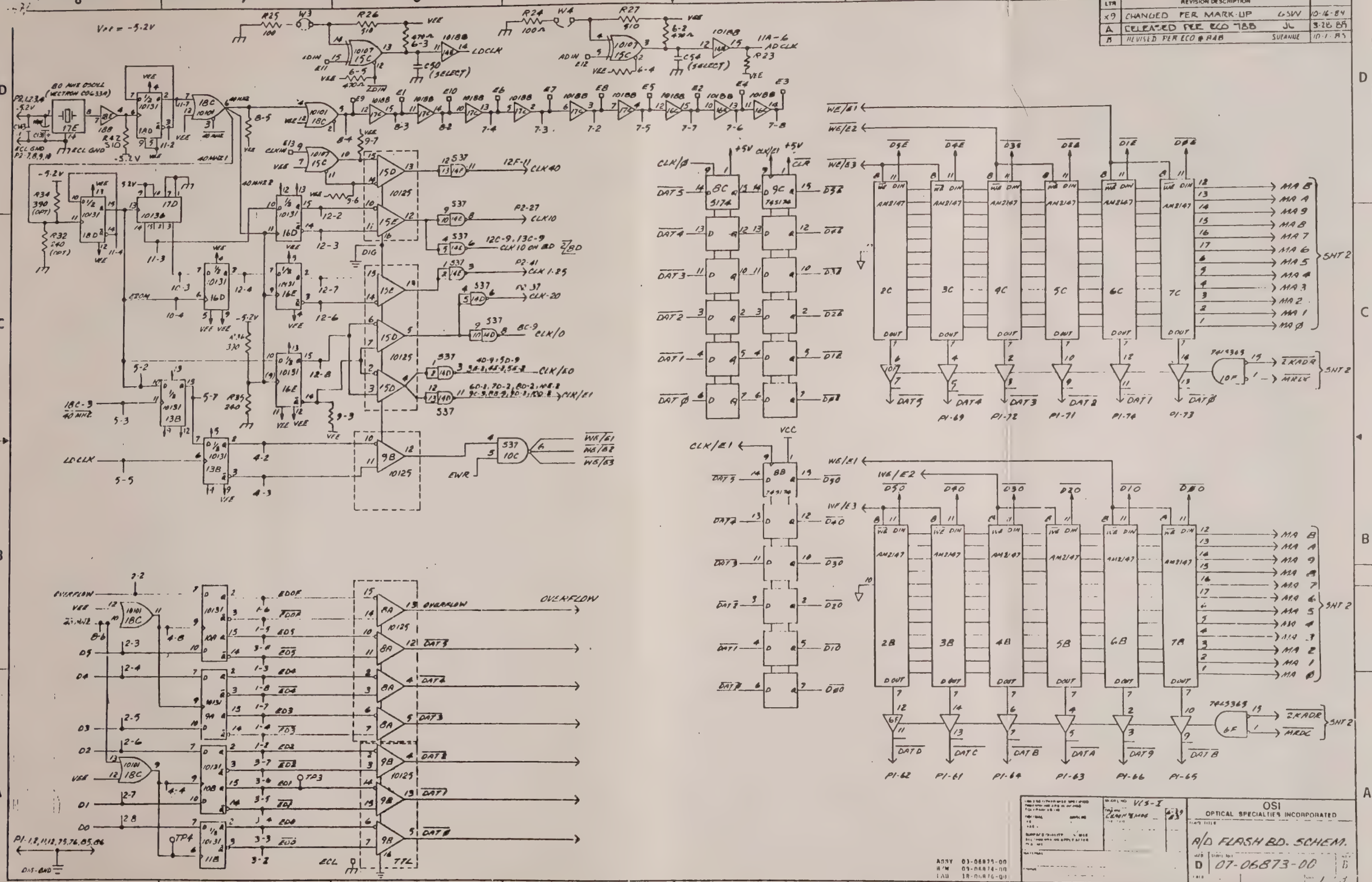
REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
A	RELEASED PER ECO 788 JL	3-29-85	

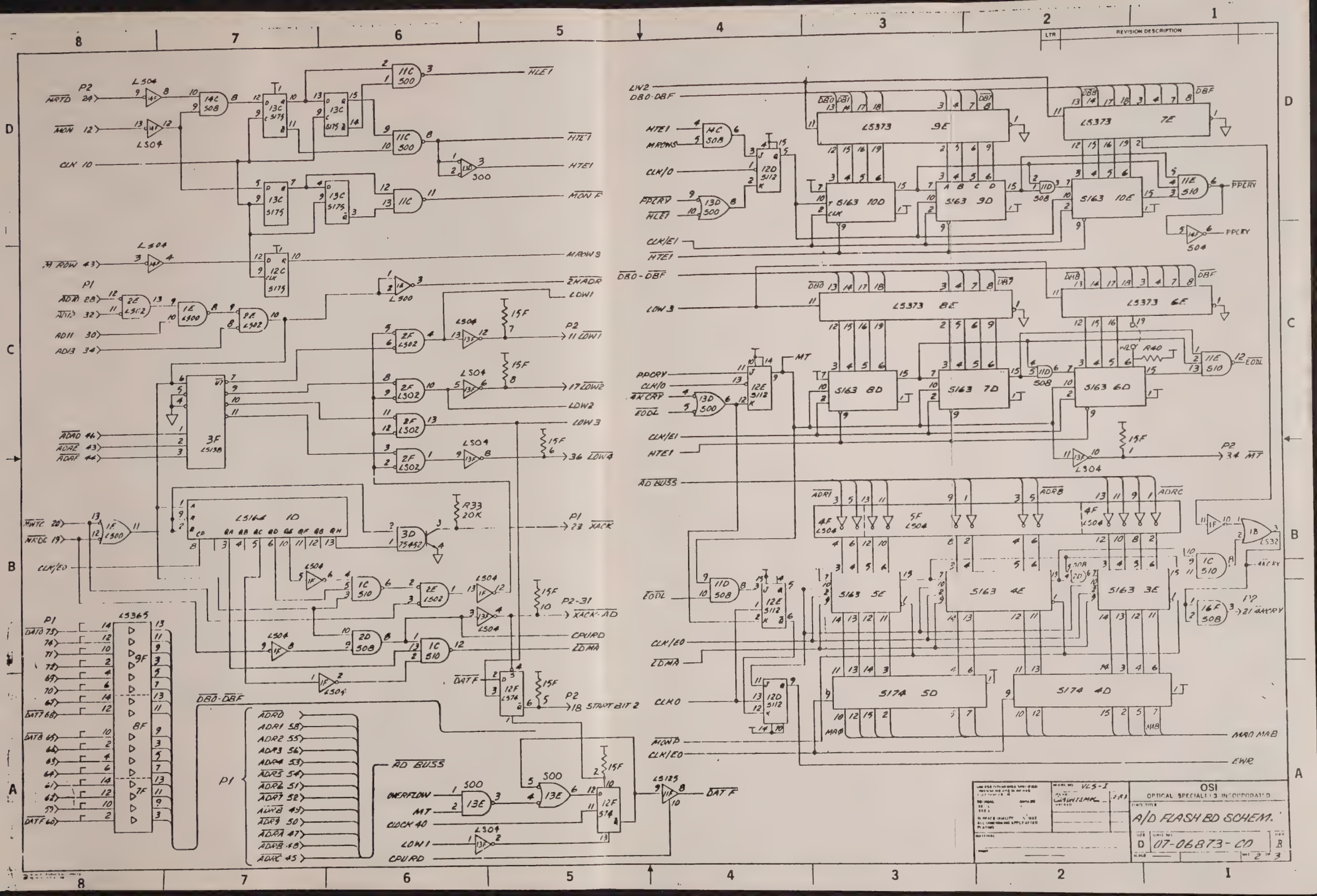


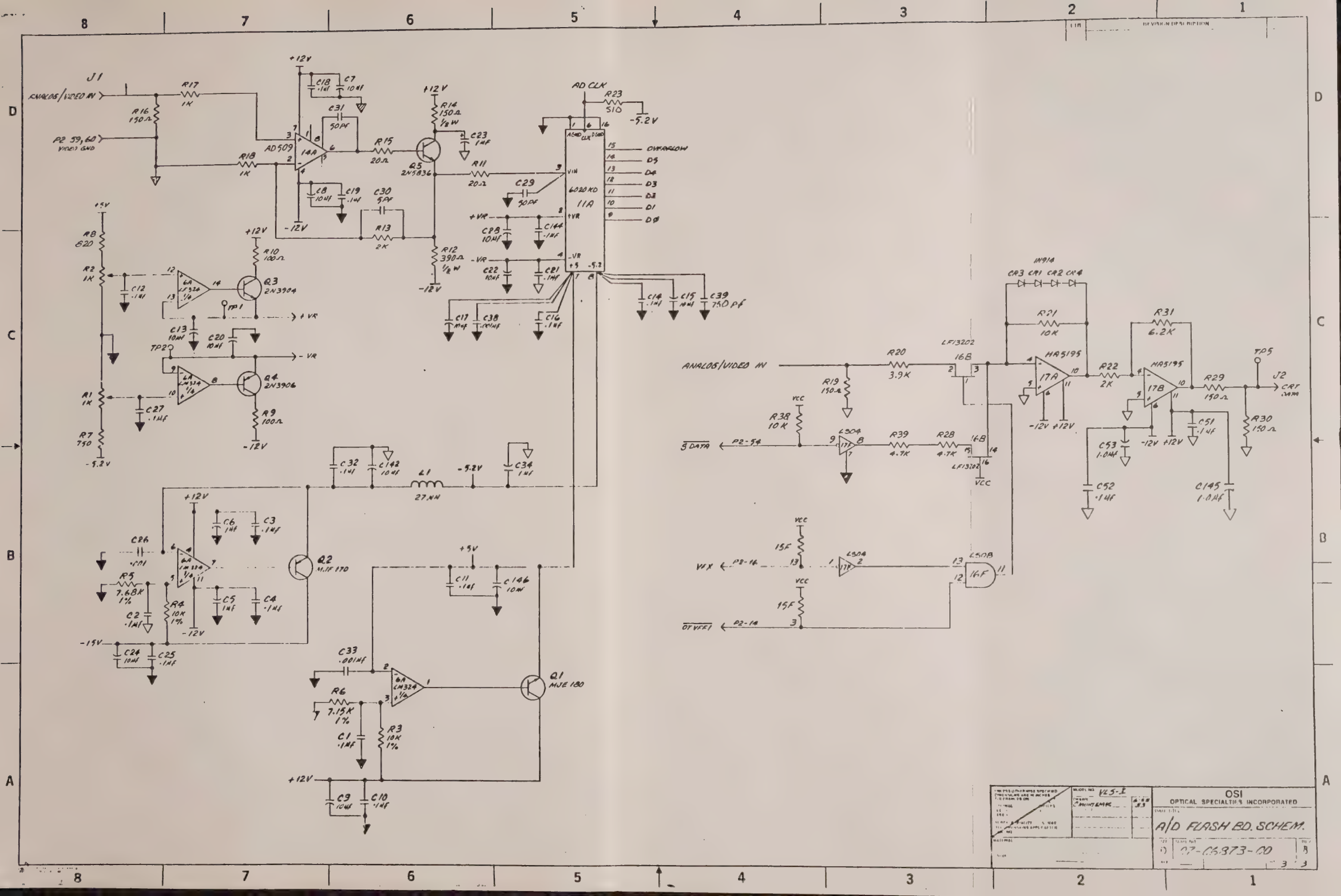
TOLERANCES UNLESS OTHERWISE SPECIFIED: FRACTIONS ± DEC ± ANGLES ±		OSI OPTICAL SPECIALTIES INCORPORATED	
APPROVALS	DATE	CONNECTOR, PCB, VLS-I, SCHEMATIC	
DRAWN [illegible]	9-7-83		
CHECKED		SCALE	SIZE C / DRAWING NO 07-06864-00 / REV A
		DO NOT SCALE DRAWING	SHEET 1 OF 1

BISHOP GRAPHICS INC REPRODUCTION NO 10822

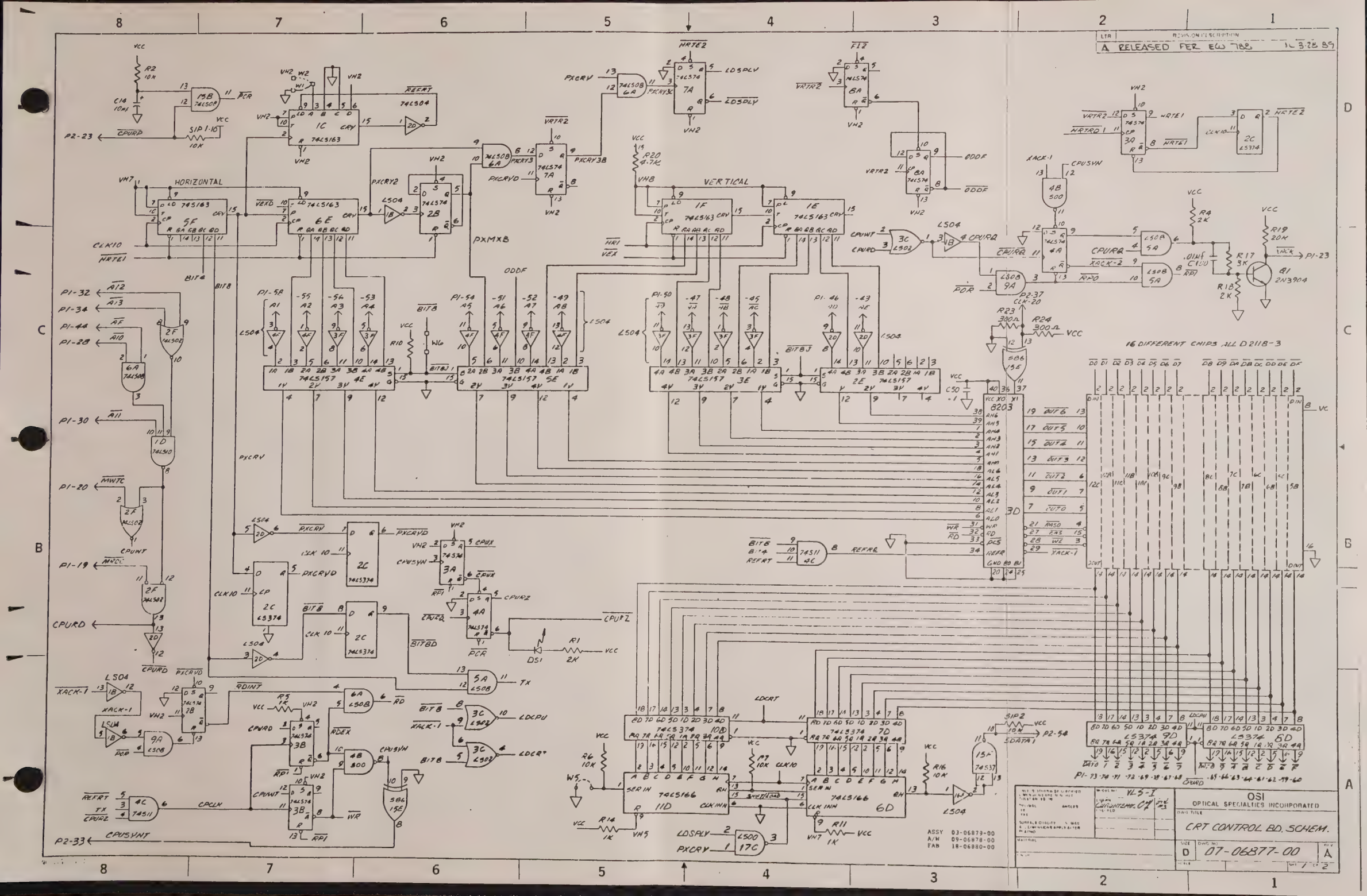
LTR	REVISION DESCRIPTION		
x9	CHANGED PER MARK-UP	GSW	10-16-84
A	RELEASED PER ECO 788	JL	3-26-85
B	REVISED PER ECO # 848	SUEANNE	10-1-85

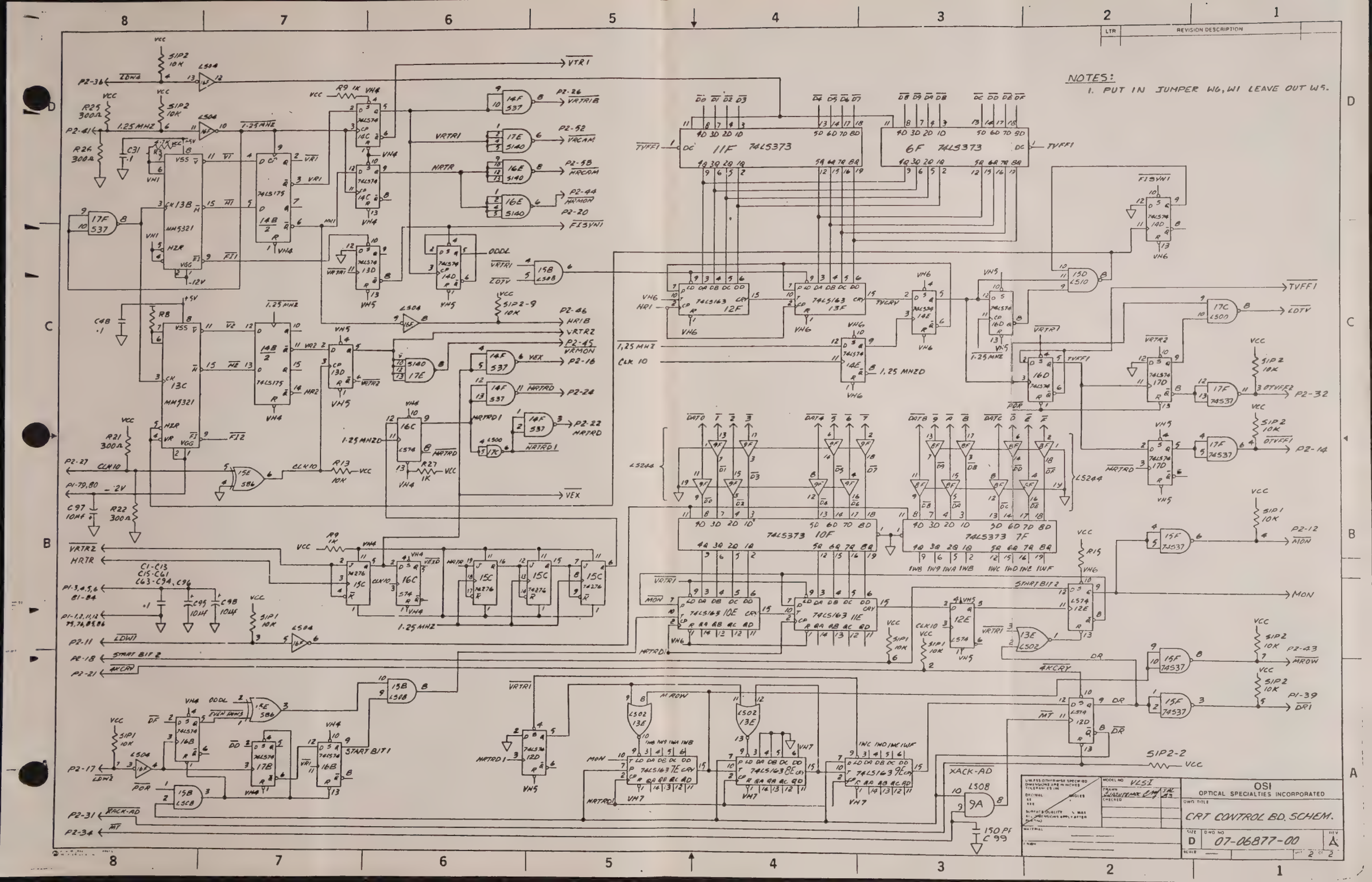


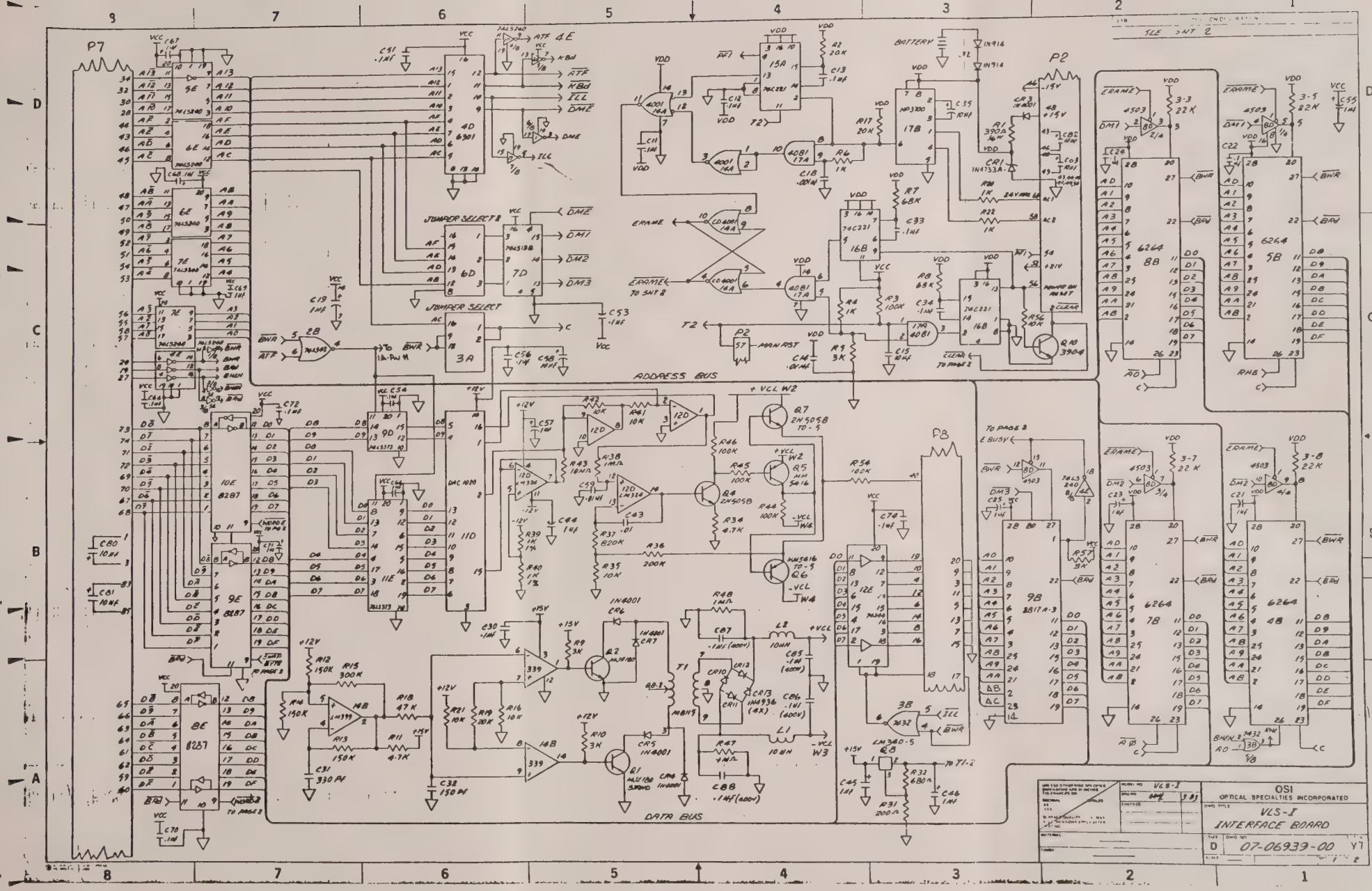

LTR
REVISION DESCRIPTION
OSI
OPTICAL SPECIALTIES INCORPORATED
A/D FLASH BD SCHEM.
VCS-I
07-06873-00
D
P1
P2
LS04
LS00
LS02
LS08
LS32
LS10
LS27
LS30
LS74
LS86
LS125
LS138
LS139
LS157
LS158
LS161
LS162
LS163
LS164
LS174
LS175
LS244
LS273
LS365
LS373
LS374
75452
3112
HLE1
HTE1
HTE1
MON F
MROWS
ZNADR
LDW1
LDW2
LDW3
LDW4
XACK
XACK-AD
CPURD
LDMA
DAT F
START BIT 2
AD BUSS
OVERFLOW
MT
CLOCK 40
EODL
EWR
MAB

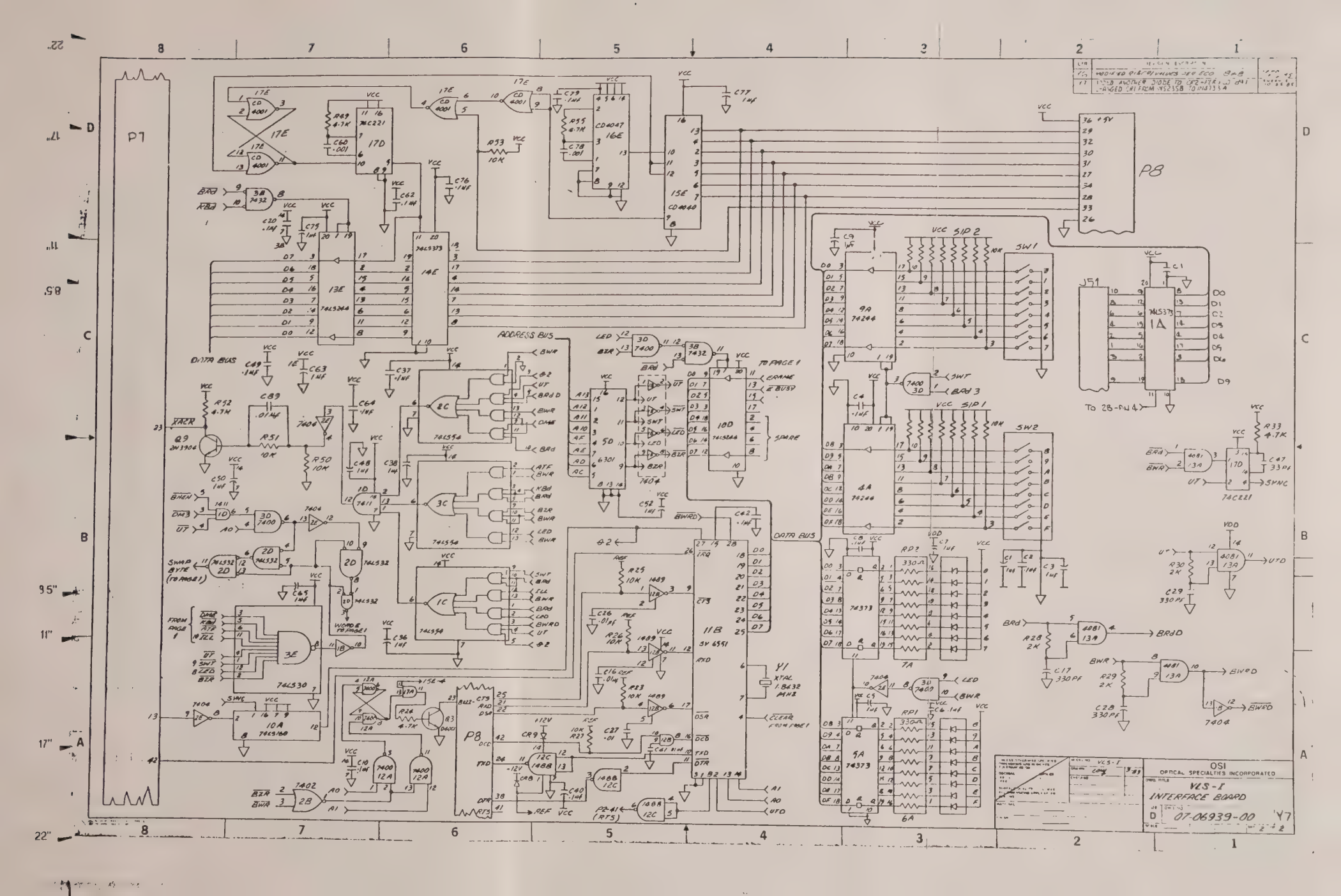


		OSI OPTICAL SPECIALTIES INCORPORATED	
	V2.5-I	A/D FLASH BD. SCHEM.	
		07-06373-00	B

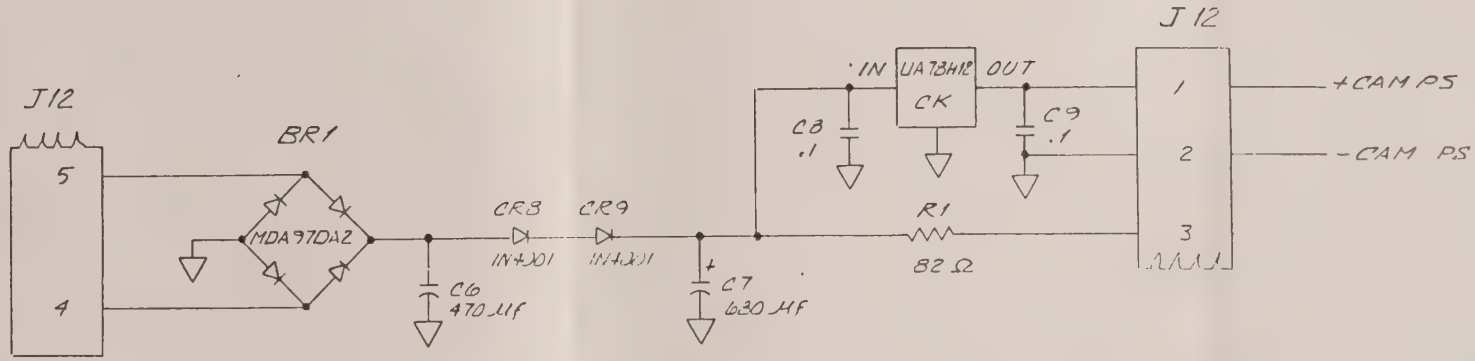

LTR
REVISION DESCRIPTION
A RELEASED PER EW 788 1C 3-28 89
HORIZONTAL
VERTICAL
PXMXB
PXCRV
ODDF
16 DIFFERENT CHIPS ALL D2118-3
CRT CONTROL BD. SCHEM.
OSI
OPTICAL SPECIALTIES INCORPORATED
07-06877-00
ASSY 03-06873-00
A/W 09-06878-00
FAB 18-06880-00


NOTES:
1. PUT IN JUMPER W6, W1 LEAVE OUT W5.
REVISION DESCRIPTION
LTR
OSI
OPTICAL SPECIALTIES INCORPORATED
CRT CONTROL BD. SCHEM.
07-06877-00
SIZE D
REV A
MODEL NO VLSI
11F 74LS373
6F 74LS373
10F 74LS373
7F 74LS373
12F 74LS163
13F 74LS163
10E 74LS163
11E 74LS163
7E 74LS163
8E 74LS163
9E 74LS163
MM5321
74LS175
74LS374
74S37
LS244
LS02
LS08
LS10
LS00
LS04
LS74
LS86
1.25 MHZ
-12V
-5V
+5V
VCC
XACK-AD
START BIT 1
START BIT 2
VTR1
VTR2
HRTR
VEX
HRTRD
HRTRD1
HRIB
VRTRZ
VRMON
HRMON
FISYN1
ODDL
LDTV
TVFF1
OTVFF2
OTVFF1
MON
DR1
MROW
DR
MT
XACK-AD
150 PF C99


P7
P2
P8
ADDRESS BUS
DATA BUS
JUMPER SELECT B
JUMPER SELECT
ATF 4E
OSI
OPTICAL SPECIALTIES INCORPORATED
VLS-I
INTERFACE BOARD
07-06939-00

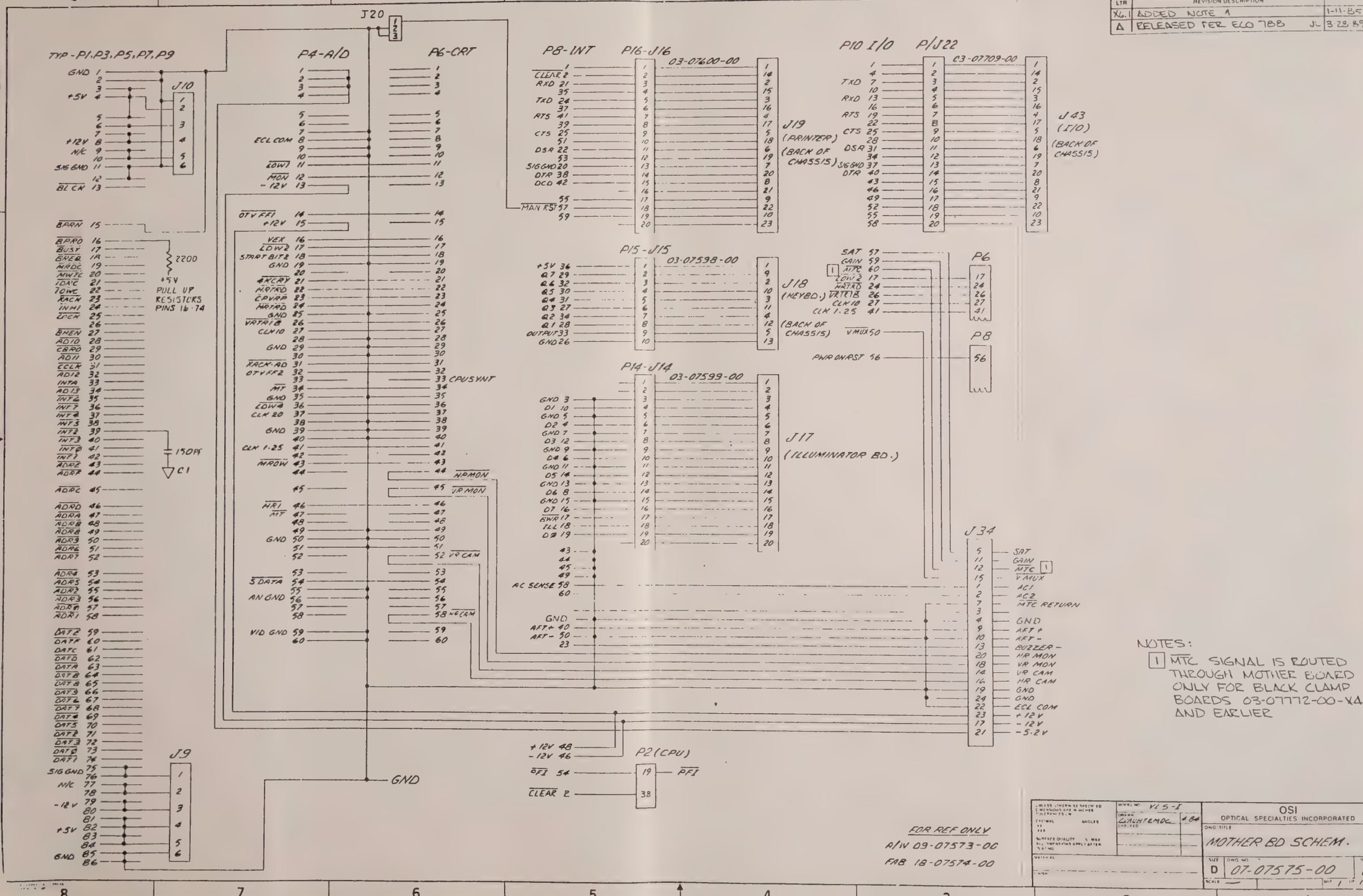

OSI
OPTICAL SPECIALTIES INCORPORATED
VLS-I
INTERFACE BOARD
07-06939-00
A7
P7
P8
ADDRESS BUS
DATA BUS
TO PAGE 1
FROM PAGE 1
SPARE
XACR
BRD
BWR
SYNC
UTD
CLEAR FROM PAGE 1
TO 28-PIN 4
SW1
SW2
SIP 1
SIP 2
Y1
XTAL 1.8432 MHz

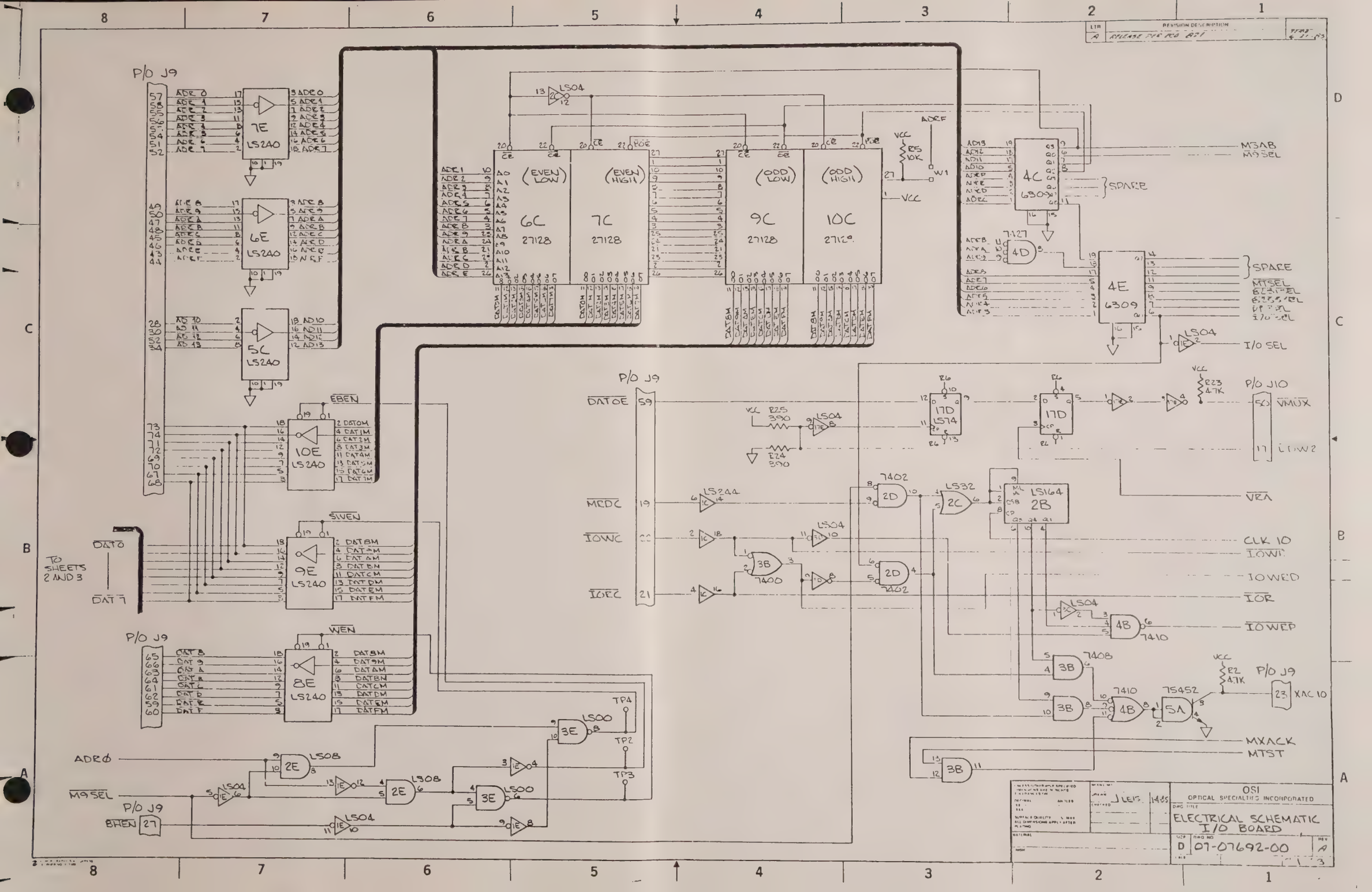
LTR	REVISION DESCRIPTION	
X6	DELETED 2TV. POWER SUPPLY	09-28-84
X7	BOARD WAS MADE SMALLER	1-4-85
A	RELEASED PER ECO 788 JL	3-28-85

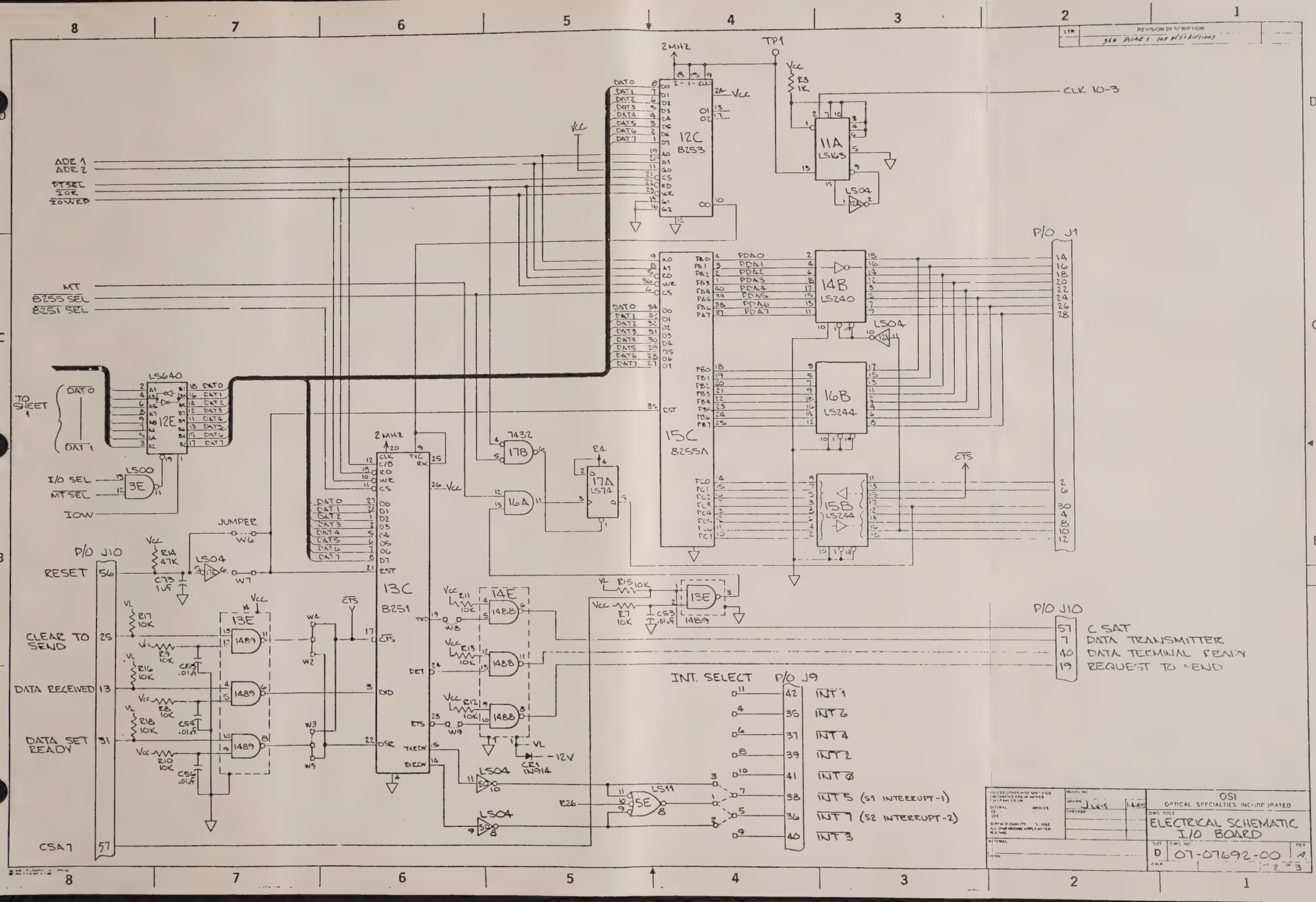


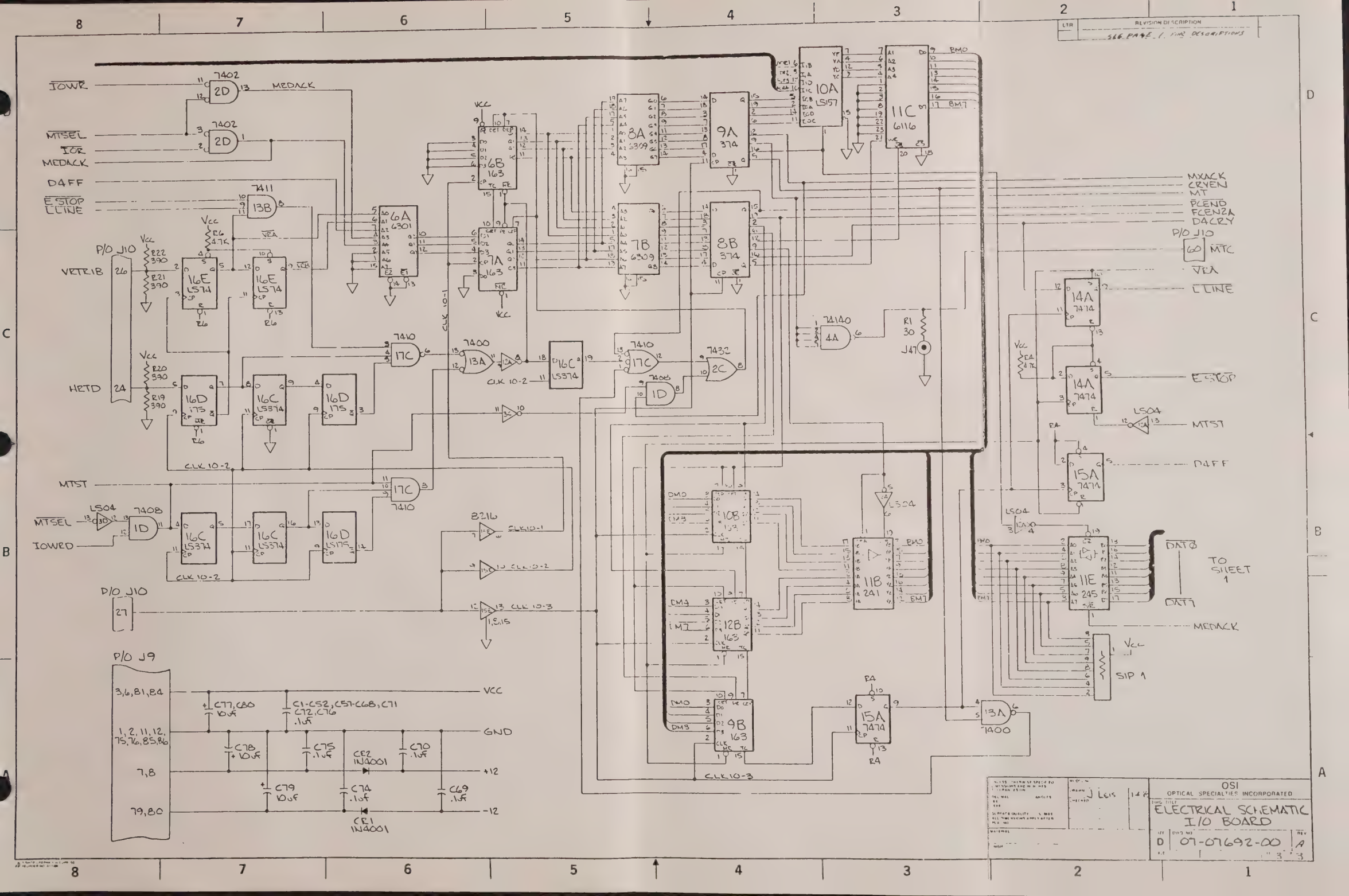
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMAL ANGLES .XX .XXX SURFACE QUALITY ALL DIMENSIONS APPLY AFTER PLATING	MODEL NO VLS-I	OSI OPTICAL SPECIALTIES INCORPORATED
	DRAWN CUAUHTEMOC 3-84	DWG TITLE SCHEM. BUZZER PCB, VLS-I
	CHECKED	
MATERIAL		SIZE C DWG NO 07-07416-00 REV A
FINISH		SCALE ~ SHT 1 OF 1

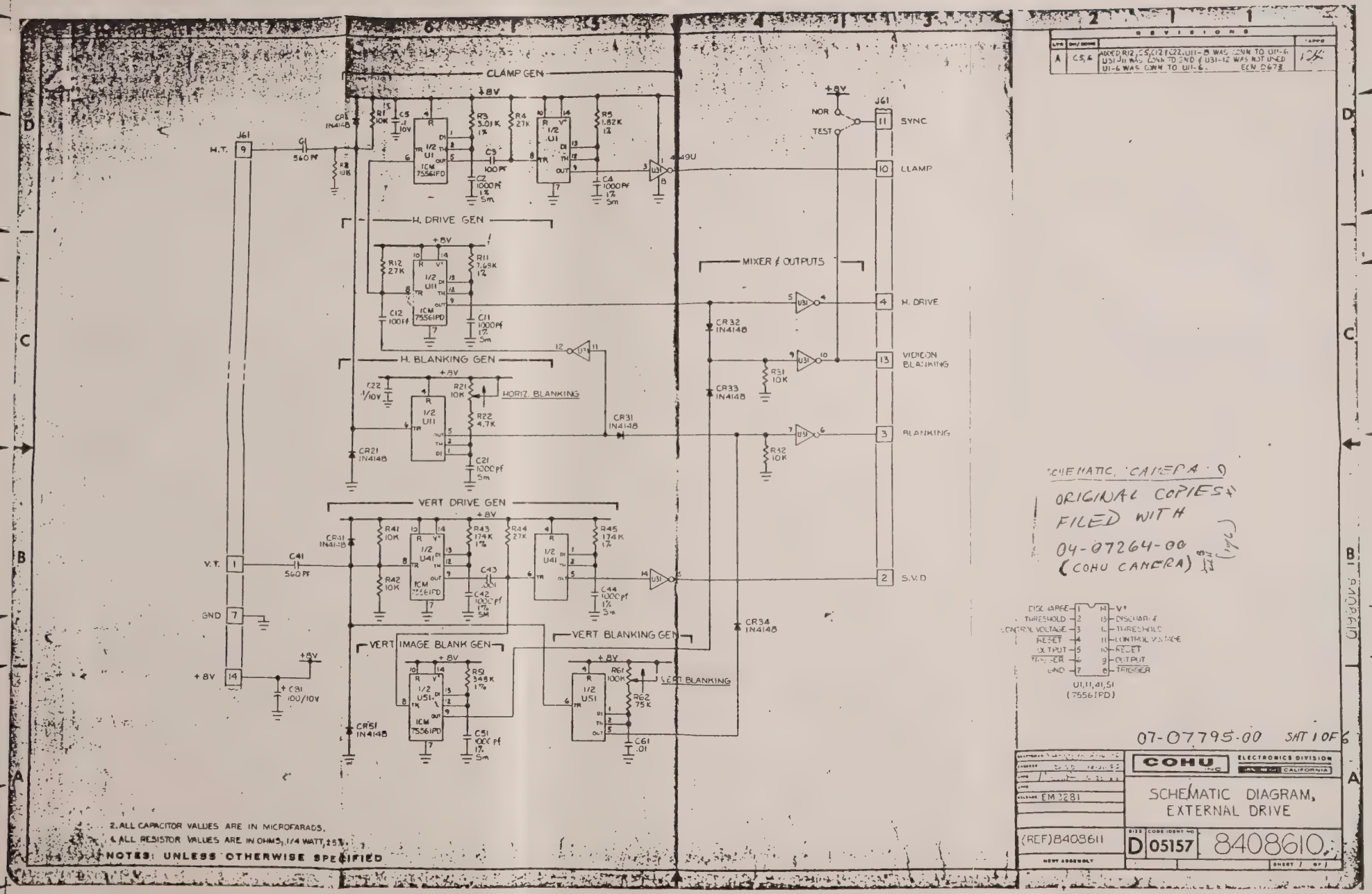
LTR	REVISION DESCRIPTION	
X6.1	ADDED NOTE 1	1-11-85
A	RELEASED PER ECO 788 JL	3 29 85




P/O J9
7E LS240
6E LS240
5C LS240
10E LS240
9E LS240
8E LS240
EBEN
SIVEN
WEN
DATO
DAT 7
TO SHEETS 2 AND 3
6C 27128 (EVEN LOW)
7C 27128 (EVEN HIGH)
9C 27128 (ODD LOW)
10C 27128 (ODD HIGH)
LS04
ADRF
R5 10K
W1
VCC
4C 6309
4D 74LS27
4E 6309
SPARE
MTSEL
I/O SEL
MSAB
MSEL
DATOE
MRDC
IOWC
IOEC
17D LS74
R25 390
R24 390
R23 4.7K
R2 4.7K
P/O J10
VMUX
LDW2
VRA
CLK 10
IOWP
IOWED
IOR
IOWEP
XAC 10
MXACK
MTST
LS244
LS32
LS164 2B
7402
7400
7410
7408
75452
ADRØ
MSEL
BREN
LS08
LS00
TP4
TP2
TP3
OSI
OPTICAL SPECIALTIES INCORPORATED
ELECTRICAL SCHEMATIC
I/O BOARD
07-07692-00
REVISION DESCRIPTION
RELEASE PER ECO A21


REVISION DESCRIPTION
SEE PAGE 1 FOR DESCRIPTIONS
2MHZ
TP1
CLK 10-3
ADR 1
ADR 2
PTSEL
IOR
IOWR
MT
8255 SEL
8251 SEL
12C 8253
11A LS163
LS04
14B LS240
16B LS244
15B LS244
15C 8255A
P/O J1
LS640
12E
TO SHEET 1
DAT 0
DAT 1
I/O SEL
MT SEL
IOW
LS00 3E
JUMPER
W6
W7
RESET
CLEAR TO SEND
DATA RECEIVED
DATA SET READY
CSA7
P/O J10
13C 8251
7432 17B
16A
17A LS74
2MHz
TXC
RXC
26 Vcc
CTS
13E 1489
14E 1488
W1
W2
W3
W4
W5
W8
W9
-12V
CR1 IN914
LS11 5E
R26
INT. SELECT P/O J9
INT 1
INT 6
INT 4
INT 2
INT 0
INT 5 (S1 INTERRUPT-1)
INT 7 (S2 INTERRUPT-2)
INT 3
C SAT
DATA TRANSMITTER
DATA TERMINAL READY
REQUEST TO SEND
OSI
OPTICAL SPECIALTIES INCORPORATED
ELECTRICAL SCHEMATIC
I/O BOARD
07-07692-00
A
SHEET 2 OF 3


REVISION DESCRIPTION
SEE PAGE 1 FOR DESCRIPTIONS
IOWR
MTSEL
IOR
MEDACK
D4FF
ESTOP
LLINE
VETRIB
HETD
MTST
IOWRD
P/O J10
P/O J9
7402
7411
7410
7400
7408
7432
74LS0
LS04
8216
VCC
GND
+12
-12
CLK 10-1
CLK 10-2
CLK 10-3
MXACK
CRYEN
MT
PLEND
FCEN2A
DACRY
MTC
VRA
LLINE
ESTOP
MTST
D4FF
MEDACK
DAT0
DAT7
TO SHEET 1
SIP 1
C77,C80 10uf
C1-C52,C57-C68,C71 C72,C76 .1uf
C78 10uf
C75 .1uf
C70 .1uf
C79 10uf
C74 .1uf
C69 .1uf
CR2 IN4001
CR1 IN4001
OSI
OPTICAL SPECIALTIES INCORPORATED
ELECTRICAL SCHEMATIC
I/O BOARD
07-07692-00
SIZE D
REV A
J LEIS



REVISIONS			
LTR	DWG/DOCMT		APPD
A	C5,6	ADDED R12, C5, C12 & C22. U11-8 WAS CONN TO U11-6 U31-11 WAS CONN TO GND & U31-12 WAS NOT USED U11-6 WAS CONN TO U11-6. ECN 0673	12/

SCHEMATIC, "CAMERA" D
ORIGINAL COPIES
FILED WITH
04-07264-00
(COHU CAMERA)

07-07795-00 SHT 1 OF 6

COHU INC. ELECTRONICS DIVISION SAN DIEGO CALIFORNIA

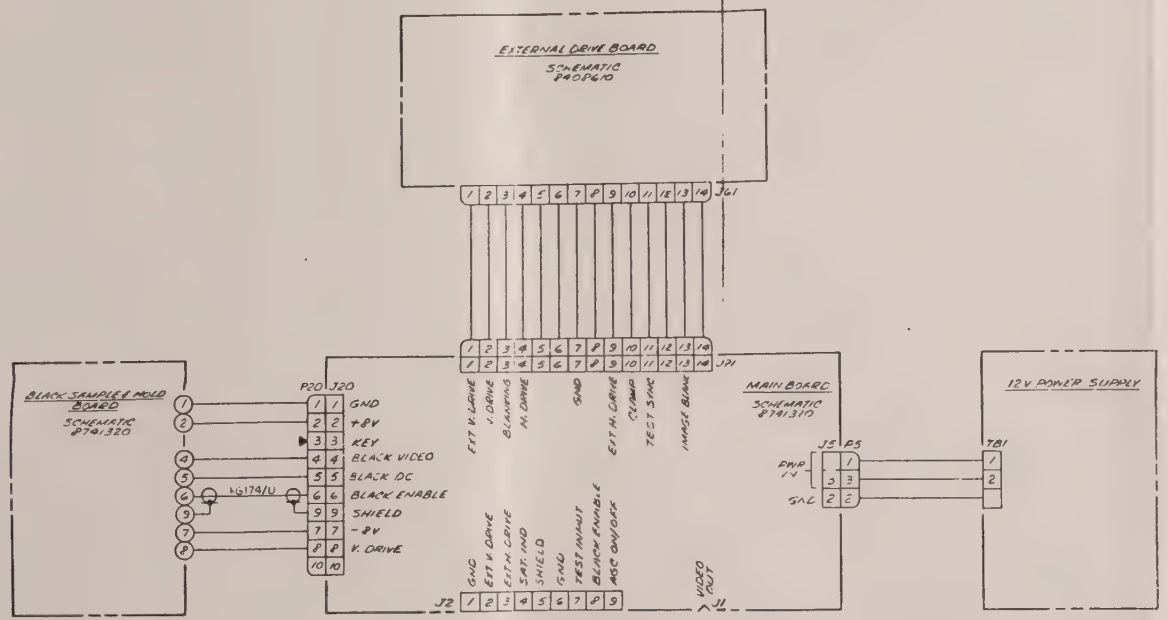
SCHEMATIC DIAGRAM, EXTERNAL DRIVE

(REF) 8408611

SIZE D | CODE IDENT NO 05157 | 8408610

NEXT ASSEMBLY

SHEET 1 OF 1



NOTES: UNLESS OTHERWISE SPECIFIED

07-07795-00 SHT 2 OF 6

COHU INC. ELECTRONICS DIVISION SAN DIEGO, CALIFORNIA

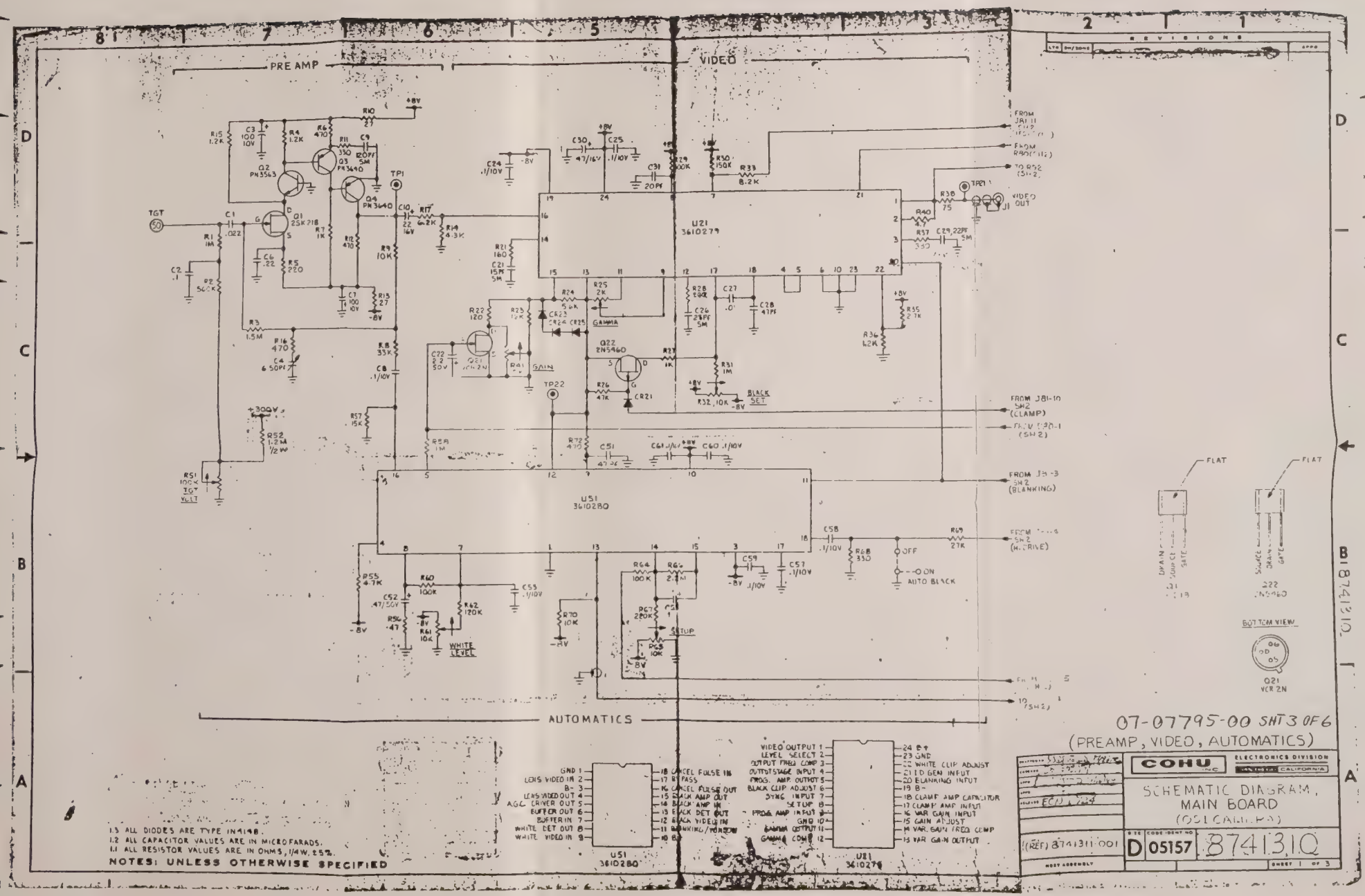
SCHEMATIC DIAGRAM, OSI CAMERA

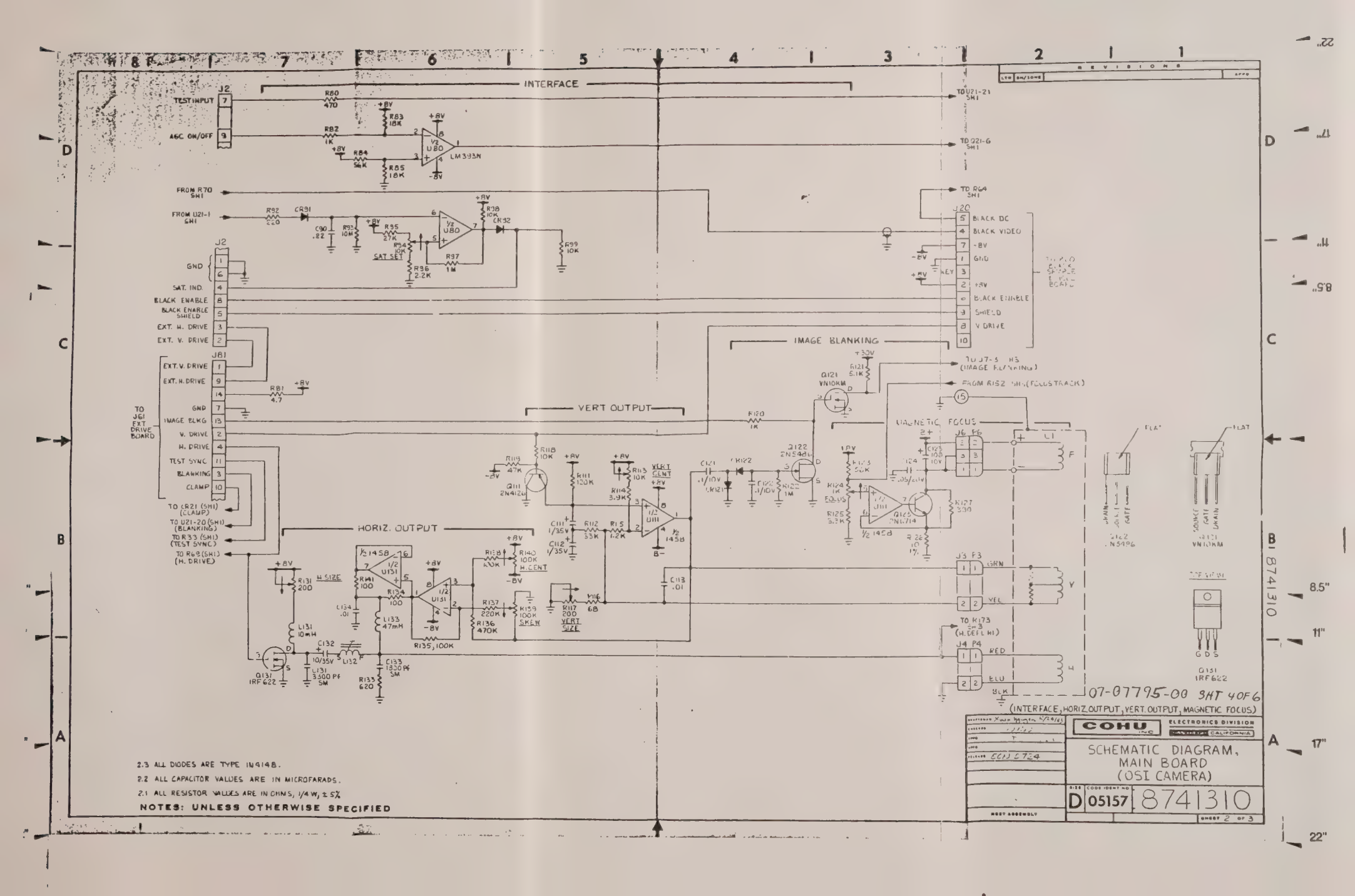
SIZE D | CODE IDENT NO 05157 | 8741300

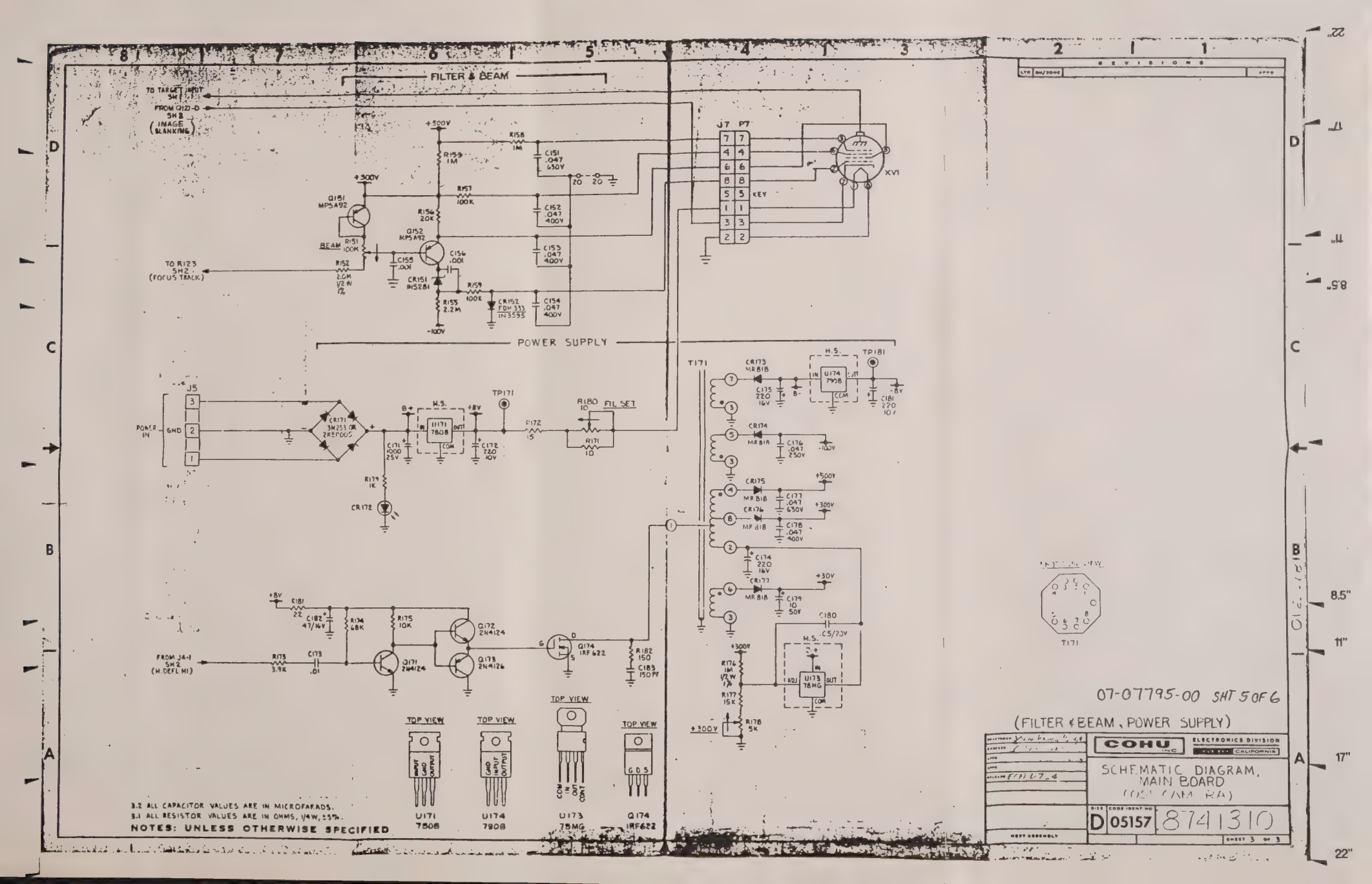
SHEET 1 OF 1

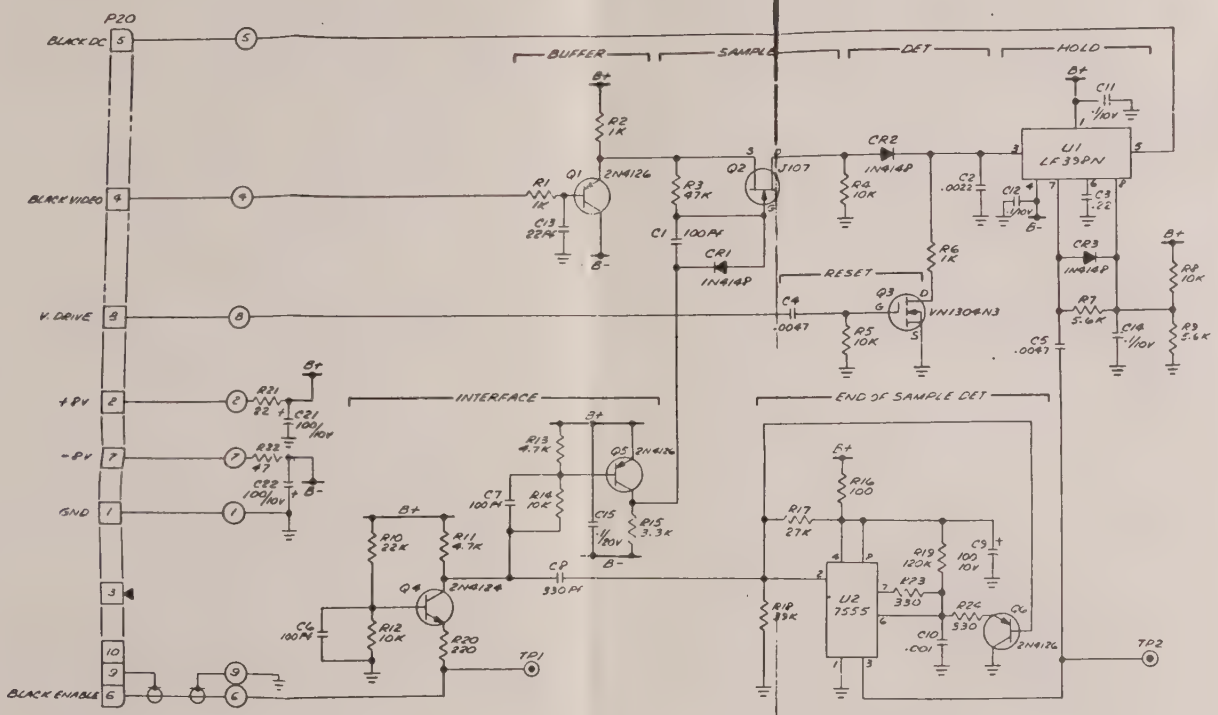
NEXT ASSEMBLY

APPLICATION

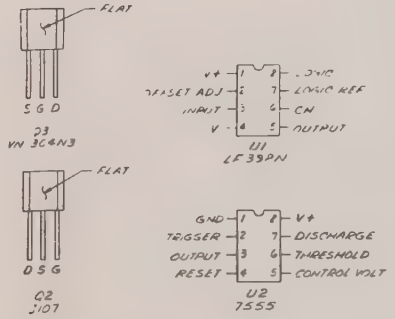

PRE AMP
VIDEO
AUTOMATICS
U21 3610279
U51 3610280
Q1 2SK 218
Q2 PN3563
Q3 PN3640
Q4 PN3640
Q21 VCR 2N
Q22 2N5460
GAIN
GAMMA
SETUP
BLACK SET
WHITE LEVEL
AUTO BLACK
FROM J81-10 SH2 (CLAMP)
FROM J81-9 SH2 (BLANKING)
FROM J81-8 SH2 (H. DRIVE)
VIDEO OUT
TO R52 (SH 2)
FROM R80 (SH 2)
TGT
TP1
TP22
BOTTOM VIEW
FLAT
DRAIN
SOURCE
GATE
NOTES: UNLESS OTHERWISE SPECIFIED
1.3 ALL DIODES ARE TYPE IN4148.
1.2 ALL CAPACITOR VALUES ARE IN MICROFARADS.
1.1 ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±5%.
07-07795-00 SHT 3 OF 6
(PREAMP, VIDEO, AUTOMATICS)
COHU INC
ELECTRONICS DIVISION
SAN DIEGO CALIFORNIA
SCHEMATIC DIAGRAM, MAIN BOARD
(OSCILLOSCOPE)
(REF) 8741311-001
D 05157 8741310
SHEET 1 OF 3
8741310


INTERFACE
TEST INPUT
AGC ON/OFF
LM393N
FROM R70 SH1
FROM U21-1 SH1
SAT SET
GND
SAT. IND.
BLACK ENABLE
BLACK ENABLE SHIELD
EXT. H. DRIVE
EXT. V. DRIVE
TO J61 EXT DRIVE BOARD
TO CR21 (SH1) (CLAMP)
TO U21-20 (SH1) (BLANKING)
TO R33 (SH1) (TEST SYNC)
TO R68 (SH1) (H. DRIVE)
TO U21-21 SH1
TO U21-6 SH1
TO R64 SH1
BLACK DC
BLACK VIDEO
-8V
GND
KEY
+8V
BLACK ENABLE
SHIELD
V DRIVE
IMAGE BLANKING
TO J7-3 HS (IMAGE BLANKING)
FROM R152 SH1 (FOCUS TRACK)
VERT OUTPUT
MAGNETIC FOCUS
HORIZ. OUTPUT
H SIZE
H. CENT
SKEW
VERT SIZE
VERT CENT
TO K173 PIN 3 (H. DEFL HI)
GRN
YEL
RED
BLU
BLK
FLAT
SOURCE
GATE
DRAIN
G D S
Q131 IRF622
2N5486
VN10KM
07-07795-00 SHT 4 OF 6
(INTERFACE, HORIZ. OUTPUT, VERT. OUTPUT, MAGNETIC FOCUS)
COHU INC
ELECTRONICS DIVISION
SAN DIEGO, CALIFORNIA
SCHEMATIC DIAGRAM, MAIN BOARD (OSI CAMERA)
D 05157 8741310
SHEET 2 OF 3
8741310
2.3 ALL DIODES ARE TYPE IN4148.
2.2 ALL CAPACITOR VALUES ARE IN MICROFARADS.
2.1 ALL RESISTOR VALUES ARE IN OHMS, 1/4 W, ± 5%
NOTES: UNLESS OTHERWISE SPECIFIED


FILTER & BEAM
POWER SUPPLY
TO TARGET INPUT SHT
FROM GI21-D SHT 8 (IMAGE BLANKING)
TO R123 SHT (FOCUS TRACK)
FROM J4-1 SHT (H.DEFL HI)
POWER IN
GND
J5
J7 P7
KEY
XV1
Q151 MPSA92
Q152 MPSA92
BEAM
CR151 IN5281
CR152 FDH 333 IN3595
CR171 3N251 OR 2KBP005
U171 7808
U174 7908
U173 78MG
Q174 IRF622
Q171 2N4124
Q172 2N4124
Q173 2N4124
CR173 MRB18
CR174 MRB1A
CR175 MRB18
CR176 MRB18
CR177 MRB18
T171
TP171
TP181
R180 FIL SET
CR178
H.S.
+500V
+300V
+30V
+8V
-100V
-8V
TOP VIEW
U171 7808
U174 7908
U173 78MG
Q174 IRF622
3.2 ALL CAPACITOR VALUES ARE IN MICROFARADS.
3.1 ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±5%.
NOTES: UNLESS OTHERWISE SPECIFIED
07-07795-00 SHT 5 OF 6
(FILTER & BEAM, POWER SUPPLY)
COHU INC. ELECTRONICS DIVISION SAN DIEGO CALIFORNIA
SCHEMATIC DIAGRAM, MAIN BOARD
D 05157 8741310



2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
1. ALL RESISTOR VALUES ARE IN OHMS, ¼W, 5%.
NOTES: UNLESS OTHERWISE SPECIFIED

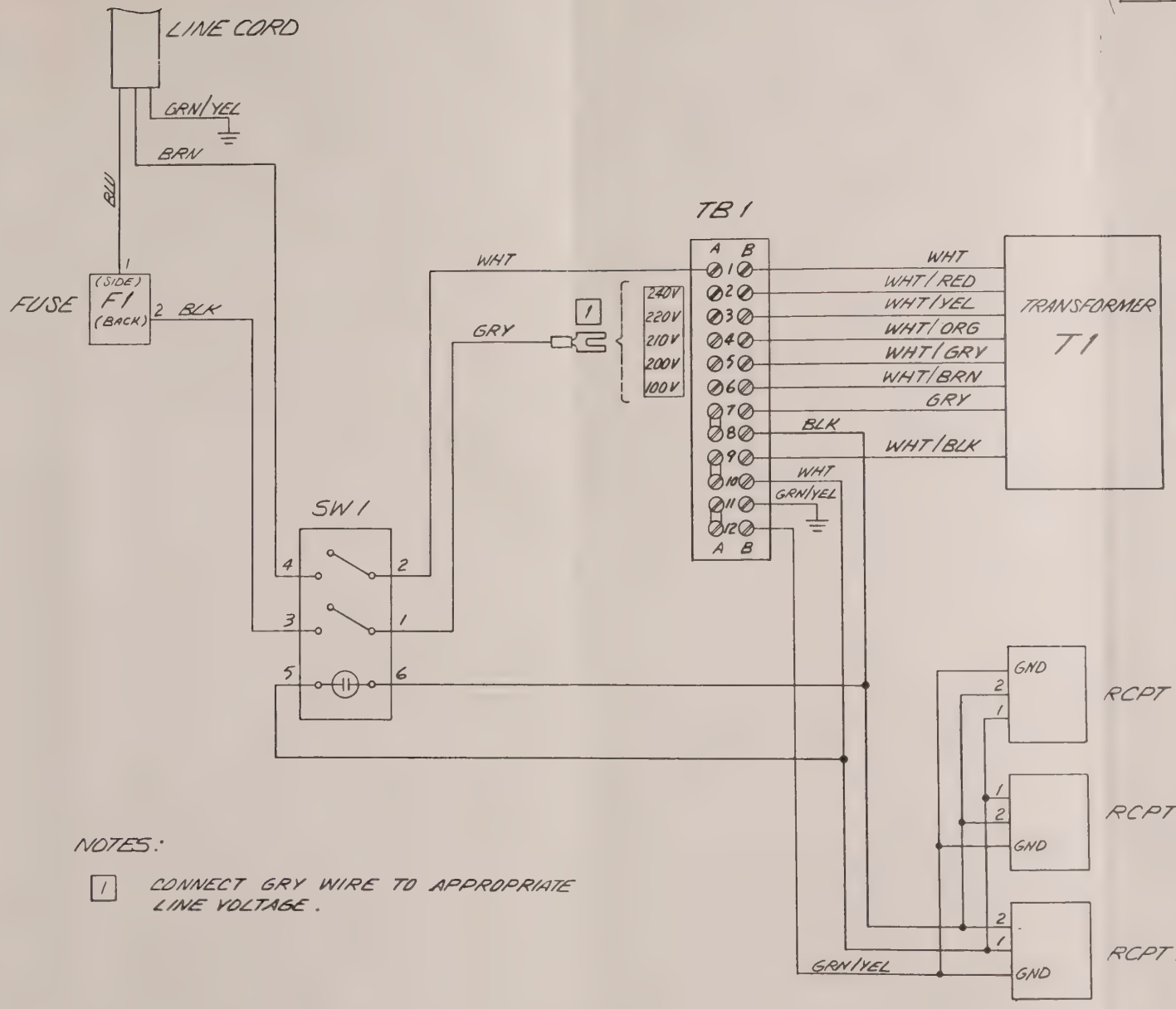


07-07795-00 SHT 6 OF 6

DRAWN G H 11-27-73	COHU INC.	ELECTRONICS DIVISION SAN DIEGO, CALIFORNIA
ENGR'D	SCHEMATIC DIAGRAM, BLACK SAMPLE & HOLD (OSI CAMERA)	
RELEASED ECR D724		
(REF) 8741321	SIZE D	CODE IDENT NO. 05157
NEXT ASSEMBLY		8741320
		SHEET 1 OF 1

B 8741320

LTR			
X4	SW1 REARRANGED	TLM	7-7-84



NOTES:

1. CONNECT GRY WIRE TO APPROPRIATE LINE VOLTAGE.

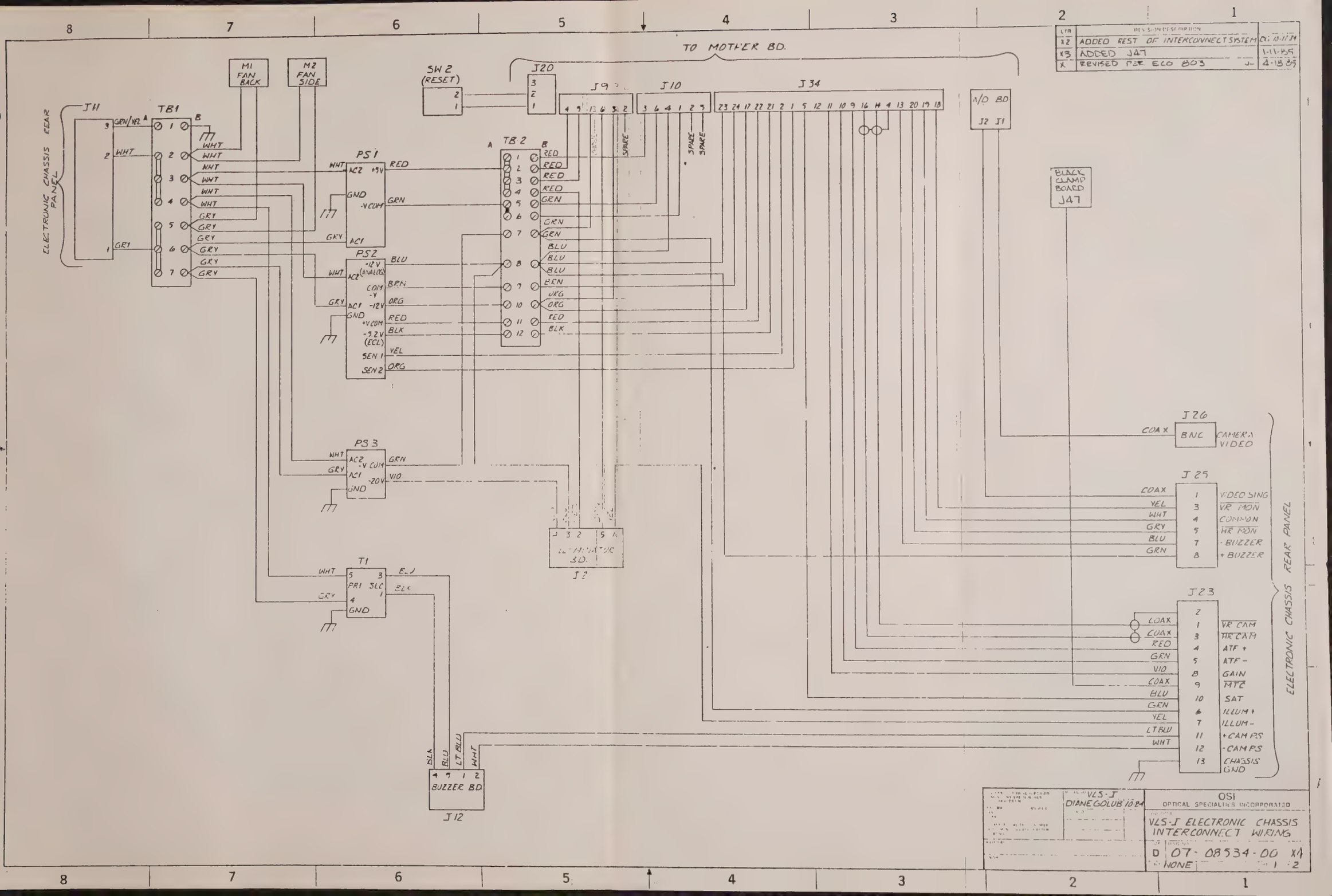
UNLESS OTHERWISE SPECIFIED DIM'NS ON ARE IN INCHES TOLERANCES ON DECIMAL XX .01 XXX .005 ANGLES SURFACE QUALITY ALL DIMENSIONS APPLY AFTER PLATING	VCS-I	5-84
MATERIAL	DRAWN CURTIS MOCK	
FINISH	CHECKED	

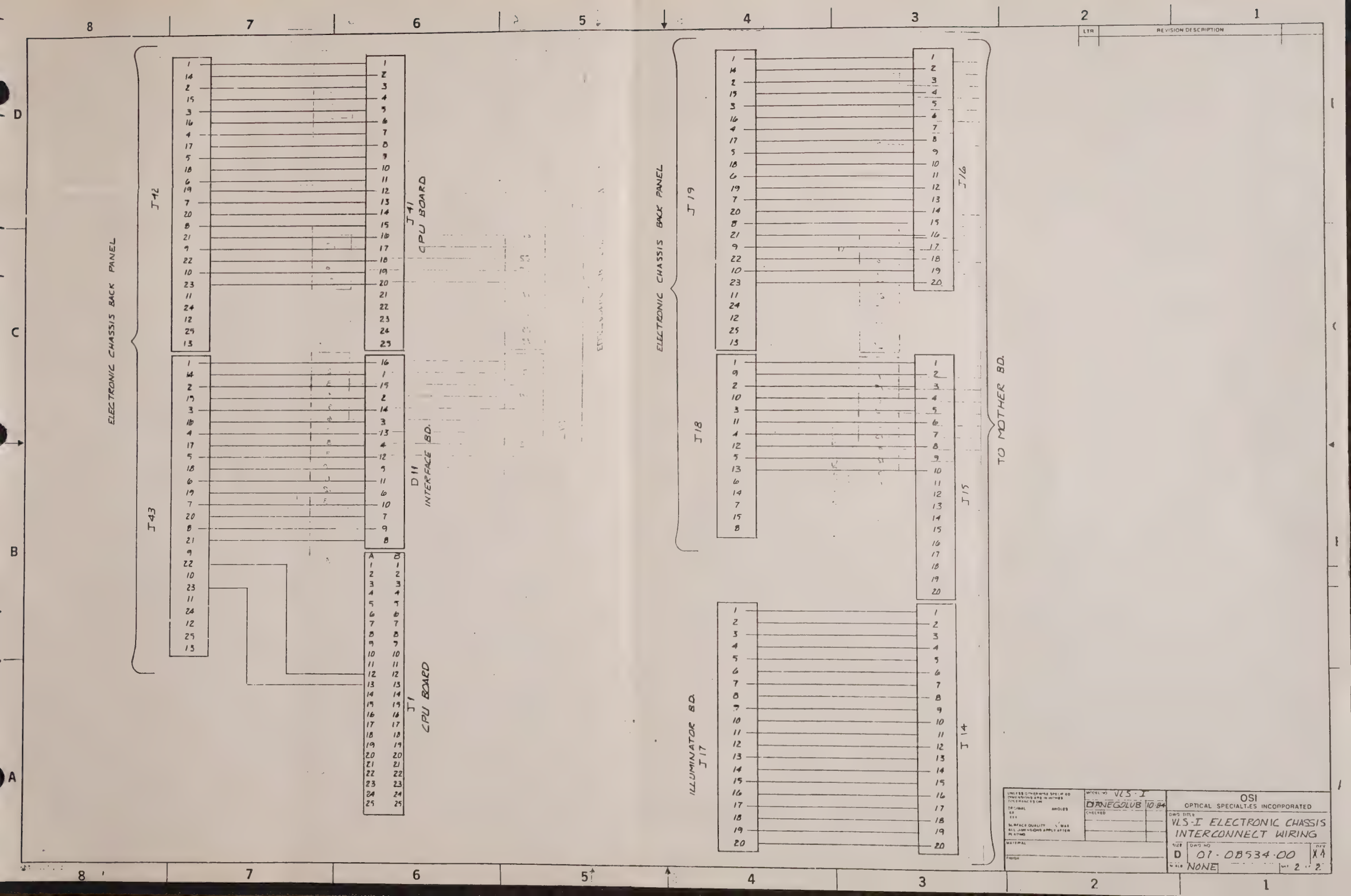
OSI
OPTICAL SYSTEMS INCORPORATED

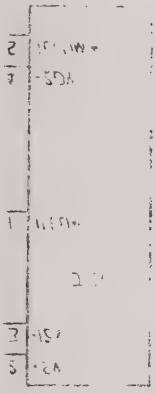
MULTI VOLT TRANSF. SCH.

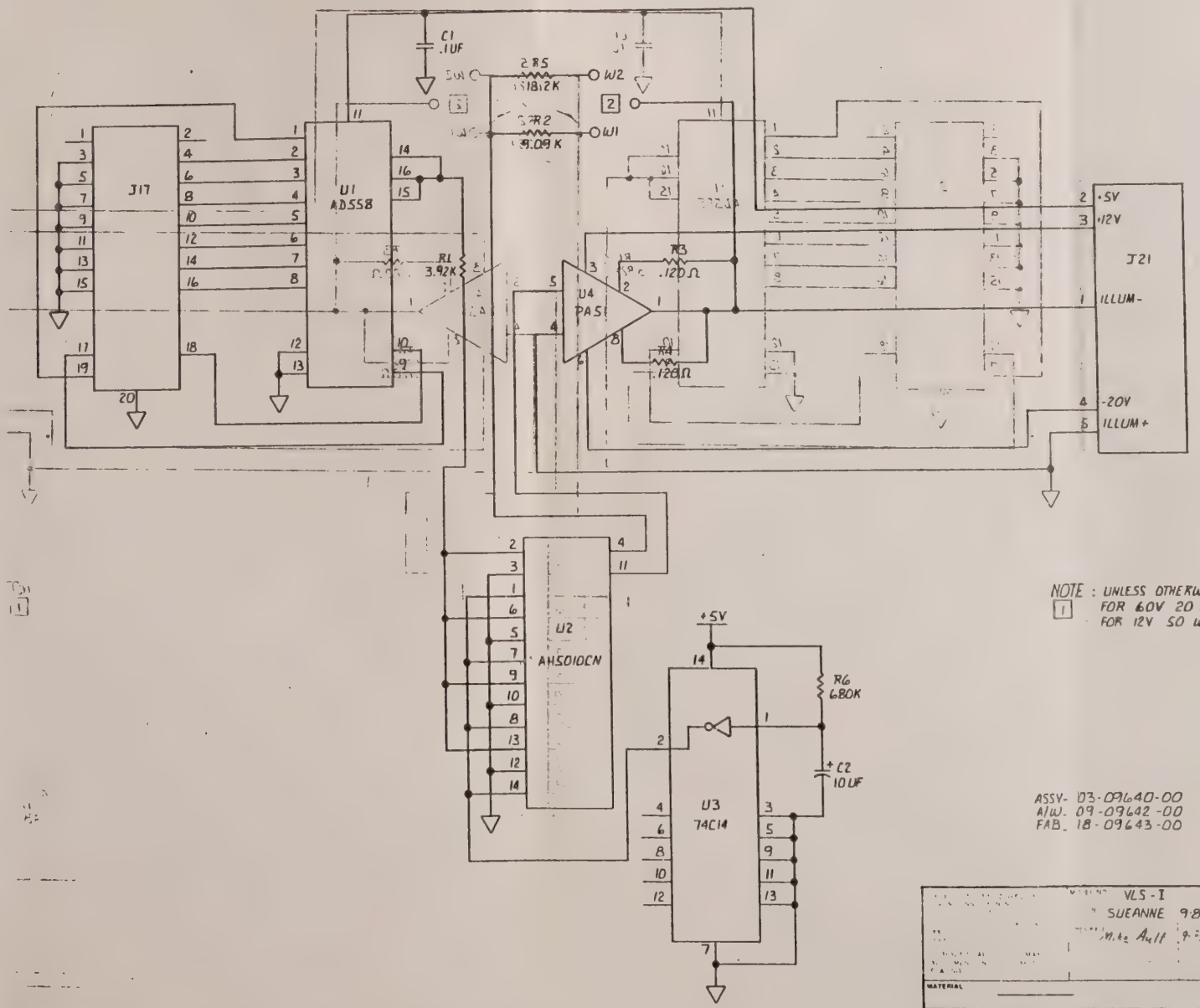
SIZE C | 07-07912-00 | X4

SCALE ~ SHEET 1 OF 1


TO MOTHER BD.
M1 FAN BACK
M2 FAN SIDE
SW2 (RESET)
J20
J9
J10
J34
A/D BD
J2 J1
BLACK CLAMP BOARD J47
J11
TB1
TB2
PS1
PS2
PS3
T1
ELECTRONIC CHASSIS REAR PANEL
SPARE
SPARE
SPARE
J26
COAX
BNC
CAMERA VIDEO
J25
VIDEO SING
VR MON
COMMON
HR MON
- BUZZER
+ BUZZER
J23
VR CAM
HR CAM
ATF +
ATF -
GAIN
MTC
SAT
ILLUM +
ILLUM -
+CAM PS
-CAM PS
CHASSIS GND
J2
BUZZER BD
J12
REV | DESCRIPTION | DATE
X2 | ADDED REST OF INTERCONNECT SYSTEM | 10-17-84
X3 | ADDED J47 | 1-11-85
X | REVISED PER ECO 803 | 4-18-85
VLS-J
DIANE GOLUB 10-84
OSI
OPTICAL SPECIALTIES INCORPORATED
VLS-J ELECTRONIC CHASSIS INTERCONNECT WIRING
D 07-08534-00 X4
NONE
1 : 2


LTR
REVISION DESCRIPTION
ELECTRONIC CHASSIS BACK PANEL
J42
J43
J41
CPU BOARD
D11
INTERFACE BD.
J1
CPU BOARD
ELECTRONIC CHASSIS BACK PANEL
J19
J18
J16
J15
TO MOTHER BD.
ILLUMINATOR BD.
J17
J14
MODEL NO VLS-I
DANEGOLUB 10-84
CHECKED
OSI
OPTICAL SPECIALTIES INCORPORATED
DWG TITLE
VLS-I ELECTRONIC CHASSIS
INTERCONNECT WIRING
SIZE D
DWG NO 01-08534-00
REV X1
SCALE NONE
WT 2.2





REVISION DESCRIPTION

A : RELEASE PER ECO 890 tmo 12-2-85

NOTE : UNLESS OTHERWISE SPECIFIED.
[1] FOR 60V 20 WATT LAMPS JUMPER TO W1.
FOR 12V 50 WATT LAMPS JUMPER TO W2.

ASSY- 03-09640-00
A/W- 09-09642-00
FAB- 18-09643-00

VLS-I
SUEANNE 9-85

OSI
OPTICAL SPECIALTIES INCORPORATED

SCHEM
ILLUMINATOR BOARD

SIZE C | DWG NO 07-09641-00 | REV A

SCALE | SHT 1 OF 1

MP MASTER
MA32963